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Machines With Built-In Motors

THIS article gives a concise outline of what has been accomplished in building motors into machines for various kinds of work. The direct connection of motor to the spindle involves the question of the speed and the number of changes desired. For this reason the use of belts or chains is likely to continue as the connecting link between motor and spindle for many classes of machines. The illustrations are not confined to machine tools but show the trend toward individual or unit drives in a number of widely separated fields.

By D. K. Frost

Industrial Department, General Electric Co.

A few examples of the way designers are incorporating motors into machines—Whether motors are to be used belted or direct, depends largely on the speed

THE present trend of machine design is toward built-in motors, as indicated by the increasing number of machines of the unit type. In the present discussion of the subject, machines with built-in motors an designated as of the unit type to differentiate them from those adapted for individual drive. A machine for individual drive is usually provided with pads, or a bracket, or a special base on which the motor may be mounted. The drive is then completed by means of belting, gearing or silent-chain drive.

In many cases the rotor of the motor is directly mounted on the spindle or shaft that carries the cutting tool or working member of the machine, eliminating all intermediate driving mediums.

On first thought, it would appear that the electrical manufacturers would be reluctant to design a variety of different motor parts for fitting into machines. But experience has shown that, when these so-called special motors are developed and produced in quantities, the design soon becomes standardized and they are found to be a desirable line of manufacture.

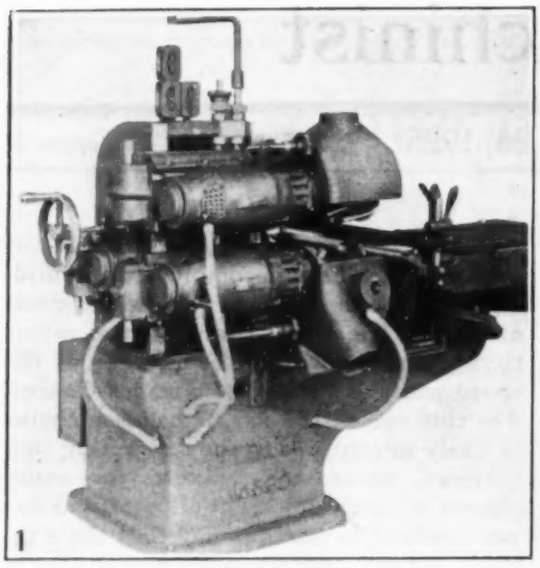
An Analysis of Motor Drives

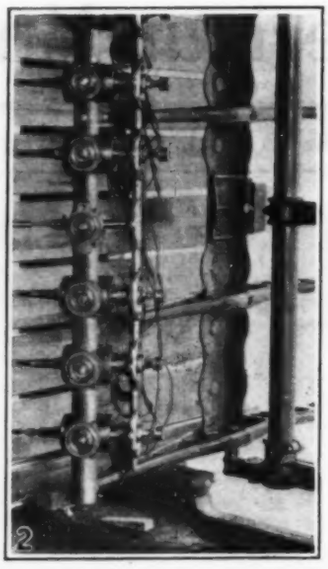
An analysis of the shop equipment review in the July 17, 1924, issue of the *American Machinist* reveals the fact that, of the metal working tools designed in the previous six months, 22 per cent were of the unit type, 45 per cent were designed for individual drive and 32 per cent were fitted for belting from a countershaft. Fifteen per cent of this 32 per cent could be modified for individual drive, leaving a scant 17 per cent adapted only for belting from line shafts. In the January, 1925, review these percentages becames approximately 30 per cent unit machines, 51 per cent individual drive and 19 per cent for line shafting, and of the latter group 10 per cent could be modified for individual drive.

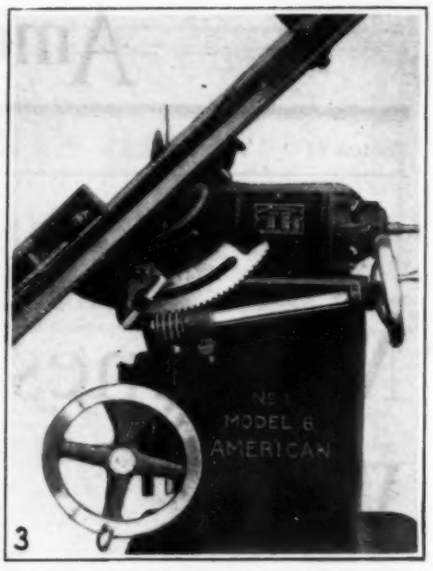
Replacing Old Types with Unit Drive

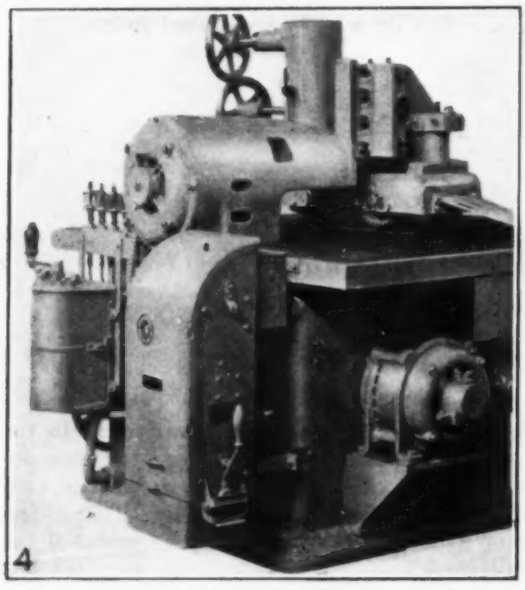
The specialty manufacturer has been foremost in offering these refinements in design, operating convenience and higher speed production that every progressive company must utilize in its manufacturing program, if it is to keep abreast of its competitors in capacity, quality and price. It is evident that many manufacturers are going through their plants and replacing the old type of machine with the unit type, or with individually driven machines that will give a better quality of work or greater production and eliminate the greatest amount of direct labor. In making an analysis of plant conditions, a careful survey will show that the largest items of expense are labor and material, and any appreciable increase in production facilities and economies, with respect to these two items, will pay for the initial expense of up-to-date machines in a surprisingly short time.

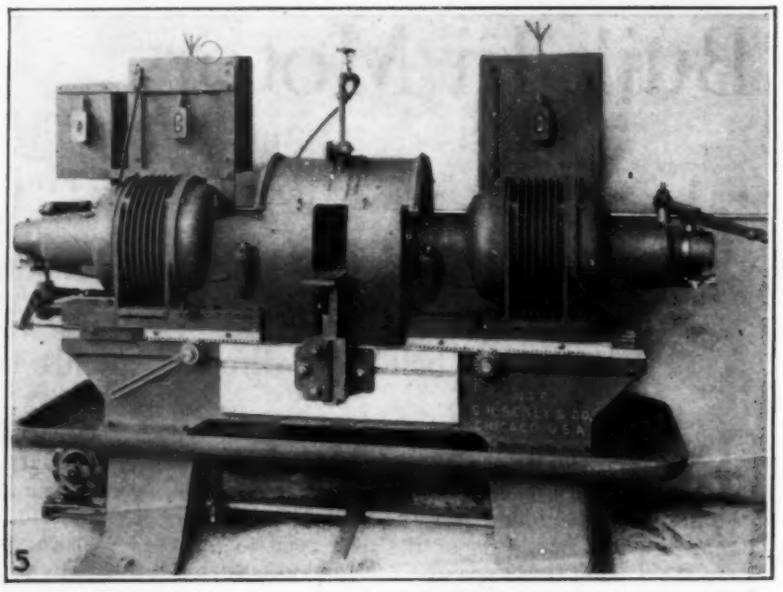
It is a question of relative values. In other words, a decrease of 10 per cent in production cost and an increase of but 5 per cent in production (estimated on an approximation that the items of labor and material constitute 50 per cent of the total cost) would represent a saving of 7½ per cent (15 per cent of 50 per cent).

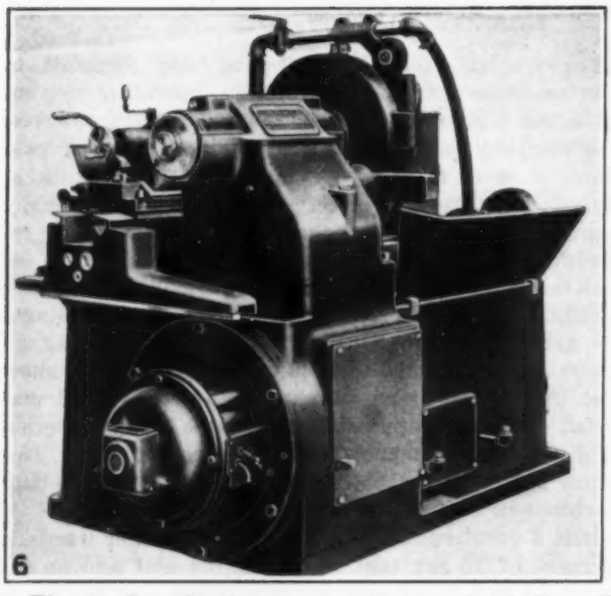












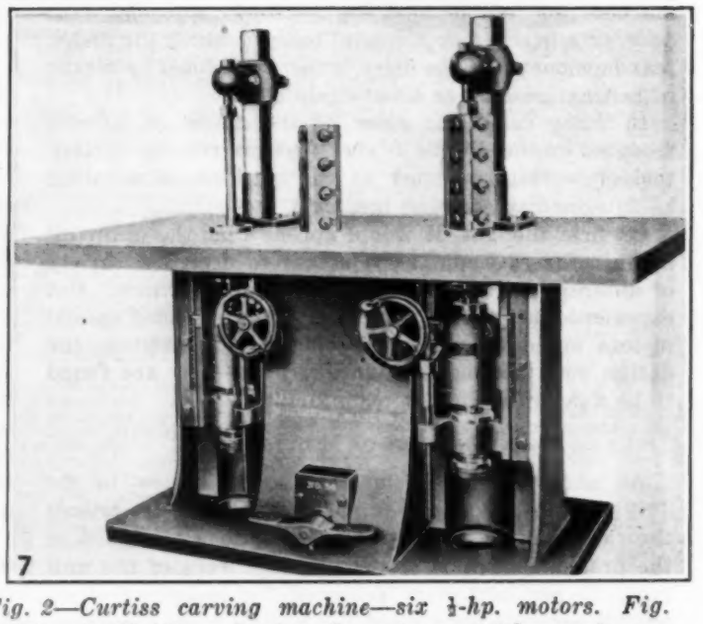


Fig. 1—Greenlee tenoner—motors on 3 spindles. Fig. 2—Curtiss carving machine—six ½-hp. motors. Fig. 3—American variety saw bench—4-hp. motor. Fig. 4—Mattison jointer-edger-ripper—15-hp. motor on spindle, 4 hp. on feed. Fig. 5—Besly double-head grinder—7½-hp. motor, each spindle. Fig. 6—Cincinnati saddle-type grinder—10-hp. motor. Fig. 7—Whitney two-spindle shaper—4-hp. motor, each spindle

On the other hand, placing the cost of power at 5 per cent of the total cost, a saving of 15 per cent would mean but 0.75 per cent (15 per cent of 5 per cent) actual saving on the total cost. It will therefore be seen that too much emphasis cannot be placed on productive results.

Another factor to be considered is the unit machine, which, with its better control for the operattor, convenience, balance and reserve power, will in many cases, produce a quality of work that saves subsequent operations on the material or piece produced. This is a direct saving, not only in material and production, but also by eliminating machines previously used in subsequent operations.

Other distinct advantages of the unit type of machine, are the very decided savings in floor space and the ease with which the machine can be moved from one location to another, when re-routing work through the factory. This factor immediately brings up the question of electrical control and wiring. Hand-in-hand with the built-in motor came the built-in control. The modern unit-machines are fully equipped with centralized control, both mechanical and electrical. The electrical control is embedded in the machine and becomes a part of it. Thus, when moving the machine, all that is necessary is to uncouple the power lines and the machine can be moved as a unit to a new location where power lines can be attached from the nearest branch circuit.

Motor Speeds Obtainable at Various Frequencies With Multi-Polar Windings

105–420 Cycles

Poles	105	120	150	180	200	240	300	360	420
2	6,300	7,200	9,000	10,800	12,000	14,400	18,000	21,600	25,200
4	3,150	3,600	4,500	5,400	6,000	7,200	9,000		
6	2,100	2,400	3,000	3,600	4,000	4,800	6,000		
8	1,575	1,800	2,250	2,700	3,000	3,600			
10	1,260	1,400	1,800	2,160	2,400				
12	1,050	1,200	1,500	1,800					
14	900	1,028							
16	787								

Motor Speeds Obtainable at Various Frequencies With Multipole Windings

25–100 Cycles

Poles	25	30	40	50	60	75	80	90	100
2	1,500	1,800	2,400	3,000	3,600	4,500	4,800	5,400	6,000
4	750	900	1,200	1,500	1,800	2,250	2,400	2,700	3,000
6	500	600	800	1,000	1,200	1,500	1,600	1,800	2,000
8	375	450	600	750	900	1,125	1,200	1,350	1,500
10	300	360	480	600	720	900	960	1,080	1,200
12	250	300	400	500	600	750	800	900	1,000
14	214	257	343	428	514	643	686	762	856
16	187	225	300	375	450	562	600	625	750
18	166	200	267	333	400	500	534	600	666
20	150	180	240	300	360	450	480	540	

Unit Drives in Woodworking

The development of unit machines in the woodworking industry may safely be estimated as being from 50 per cent to 60 per cent of the total. A prominent machine manufacturer brought out this fact very forcibly by stating that four or five years ago, a machine with a motor built into it was a curiosity, but that, at the present time, a new machine designed for belting from a line shaft, is just as much a curiosity. It is logical that motorized, unit woodworking-machines should be developed among the first, because the speeds commonly used are approximately the same as those obtained from constant speed, alternating-current motors on 60-cycle circuits. These speeds are shown in the accompanying table.

As a matter of fact, the highest speed that can be obtained on standard, 60-cycle circuits (3,600 r.p.m. for two-pole motors) is not fast enough for a few of the machines and, consequently, the electrical manufacturers have developed frequency changers, that enable speeds to be stepped up to 4,800 r.p.m. (80 cycles), 5,400 r.p.m. (90 cycles), 6,000 r.p.m. (100 cycles) and 7,200 r.p.m. (120 cycles). These frequencies are the ones commonly used, but almost any frequency between 75 and 420 cycles can be obtained. The speeds between 4,800 and 6,000 r.p.m. are found most suitable for molding machines with the upper, lower and two side-head cutter motors running at these speeds, and the feed-works motor on 60 cycles. The feed motor, if desired, may be obtained with multi-polar windings providing two, three or four speeds, such as 600-1,200, 600-900-1,200 or 600-900-1,200-1,800 r.p.m., and so forth.

For high-speed drilling, internal grinding and special carving machines, the speeds have been increased to 10,800 r.p.m. (180 cycles), 12,000 r.p.m. (200 cycles), and a maximum so far of 25,200 r.p.m. (420 cycles). The power required at these higher speeds does not exceed 5 hp. and, in most cases, is lower than that. The motors at 4,800 to 6,000 r.p.m., however, are used in large quantities in sizes of from 5 to 30 horsepower.

The development of unit machines in the metal working industry will be slower because of the limitation of speeds. Not only are much slower speeds required but in many cases, the application calls for adjustable cutting speeds. These limitations are not insurmountable, and solutions of this problem are being worked out by close co-operation between the machinery and electrical manufacturers.

Built-in motor drive is not confined by any means to any single type of machinery; it is found in a highly developed form in the manufacture of laundry, baking and shoe-making machinery. Applications are also made to attrition mills, all types of centrifugals, valves, pumps and compressors. A few examples of machines of different kinds, having built-in motors, are shown herewith.

These machines include a number of lines of manufacture but do not by any means exhaust the fields into which the built-in motor is finding its way. Needless to say, the possibility as well as the advantages of the built-in motor affects the design of the machine itself and affords opportunities for results that would be difficult if it were necessary to transmit power to the spindle by belt, shafting or gearing. The built-in motor is particularly useful where the spindles of the machine are not parallel but at various angles and where these angles must be changed at times.

Seen and Heard

By John R. Godfrey

Selling new ideas in machine construction

JUST what is a production manager interested in about a new machine? And just what should he be interested in?

Just how much is he interested in details of the machine he buys—and how much should he be interested? Does he care whether it has plain bearings, roller bearings, or ball bearings—or any bearings at all for that matter—so long as it gives him maximum production at minimum cost?

There are, as usual, several angles to the question. If the production manager is an engineer and interested in machine design, he will naturally favor machines that embody his idea of what constitutes a good principle. If on the other hand, the production manager is mainly interested in securing the maximum production, and has no interest in design, the salesman who tries to talk special features is largely wasting his breath. The guaranteed production cost would sell the machine regardless of details of its construction.

The man who is interested solely in production is the main hope of the designers of new and novel machinery. He has no pet notions that must be embodied in a machine—all he wants is production. If the builder is reliable and can make good on his guaranty, the details of design have no interest for him.

In both cases, however, the choice of new machines is largely influenced by the experience with older machines. If drilling machines with ball bearings, for example, have given less trouble than those with plain bearings, or if they have given greater production, both men will naturally look favorably on ball bearings in other machines. And so on down the list of other details.

The question of who is most interested in special devices, such as the kind of bearing, or type of motor, is vital to the sales organization of every manufacturer of such devices. Must their sales effort be directed at the maker or at the user of the machine. If the device adds to the cost of the machine, both the builder and user must be shown that it pays, either in the rate of output or the continuity of operation. For a high production rate does not mean a large output unless it is continuous, and a few hours "down" with a troublesome bearing, or clutch, or anything else, will change the complexion of things greatly.

So, while economical production is the aim of both maker and user, the question of how to get it is still a problem for the production man. And, while strictly speaking he does not care what the machine weighs, or what kind of bearings it has, his experience with the effect of weight and with different bearings, etc., all have an effect on his judgment in selecting a new machine.

The sales force must usually attack the problem from both angles selling, the builder on the aid in helping his machines to produce, and the user on the saving of time and trouble due to avoiding shut-downs for repairs or adjustments. All of which means that even the most hard-boiled production man is interested in all details that affect either the production rate or the steadiness with which the machine stays on the job.

In this same connection, the question of guaranties is a much talked of subject among the sales force of many organizations. Just how much of a machine's performance should be covered by guaranty and for how long? Some guaranties seem to relieve the user of the necessity of exercising even ordinary horse sense in the care of the machine. The effect is frequently to have the user try to make the machine fail rather than succeed, even though success means a saving in production costs.

Here's where a little co-operation ought to pay big dividends to all concerned.

Quick-Repair Welding

From Oxy-Acetylene Tips

Frequently it is necessary to make a quick repair on some important part or else tie up an entire system. If the power plant breaks down or if some part of the power transmission system goes awry, every moment of delay will be costly. It is not uncommon for a machine part, such as the one here described to give away in the middle of production. In such cases, welding has proved itself to be of great value.

In Figs. 1 and 2 are views of a broken crankshaft that until repaired, seriously held up a quantity-production job. The diameter of this crack was 5½ in. and the crank pin was 3⅝ in. long. The knobs that were

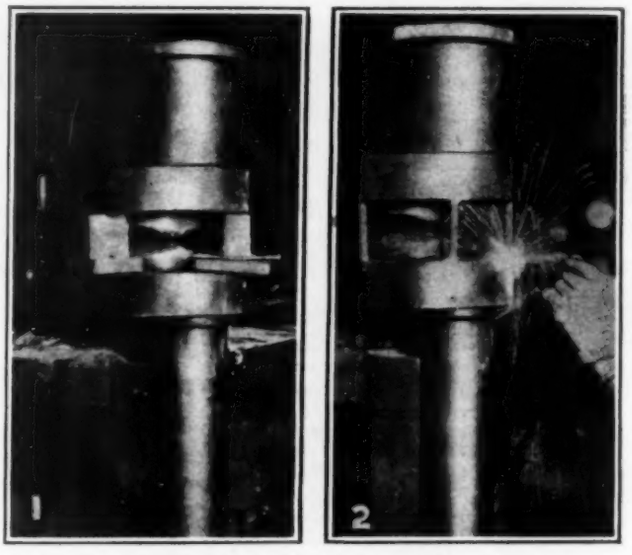


Fig. 1—Blocking the two shaft sections. Fig. 2—Welding the supports

left after the break, were chamfered to a double-V with the cutting blow pipe, and the surface carefully cleaned with a cold chisel.

The shaft was then secured in a vertical position to a leg of the welding table, and the end section was leveled and blocked in place with a 3⅝-in. space between sections. When it had been trued up, five ½-in. staybars that were exactly 3⅝ in. long were cut and tack welded as shown in Fig. 2. The staybars kept the two pieces rigid while the shaft was being turned and moved around during the welding operations.

When the staybars were all welded, a ½-in. weld was made at the center of the chamfer and then the section to be welded was laid down horizontally and thoroughly preheated. The welding was done through a hole in an asbestos covering and the new pin was built up so that it could be machined to size.

Automotive Production

Machining the Bevel-Gear Housing of the Mack Truck and Bus

By Frank W. Curtis
Associate Editor, *American Machinist*

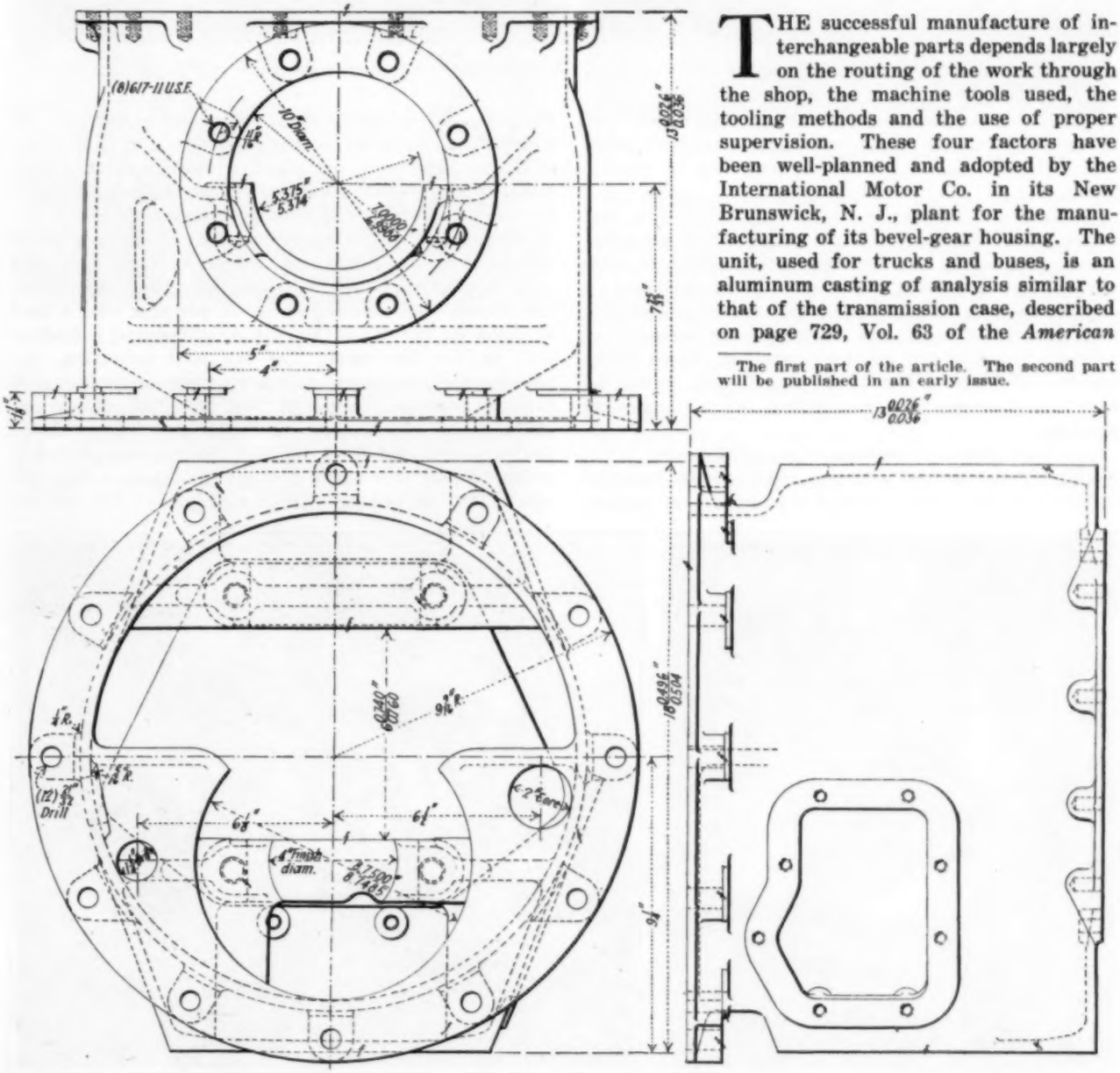


Fig. 1—Part drawing of bevel-gear housing

THE successful manufacture of interchangeable parts depends largely on the routing of the work through the shop, the machine tools used, the tooling methods and the use of proper supervision. These four factors have been well-planned and adopted by the International Motor Co. in its New Brunswick, N. J., plant for the manufacturing of its bevel-gear housing. The unit, used for trucks and buses, is an aluminum casting of analysis similar to that of the transmission case, described on page 729, Vol. 63 of the *American*

The first part of the article. The second part will be published in an early issue.

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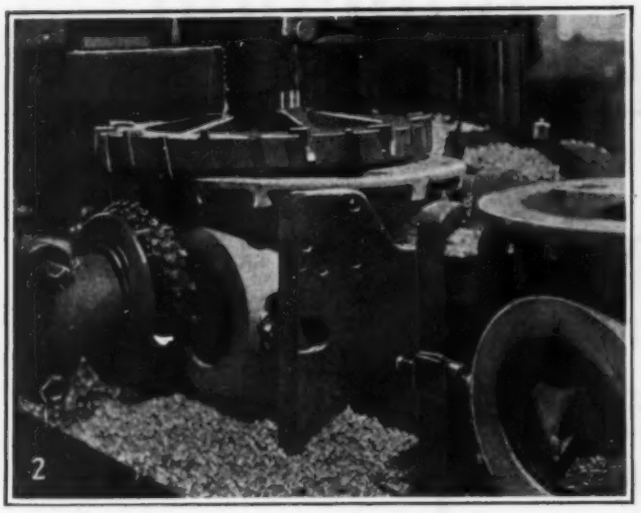

Fig. 2—Milling bottom and sides of case.

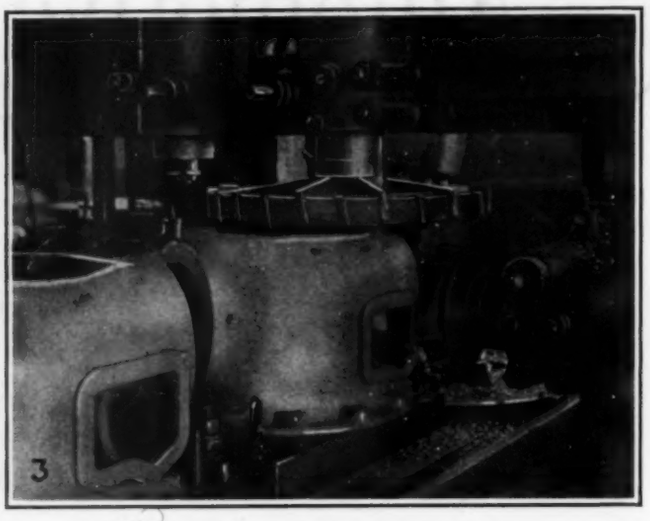

Fig. 3—Milling bottom and rear-cover pads

Machinist. The inspection follows the same practice of coating the outside with calsomine and the inside with Xylol so that any imperfections can be quickly determined.

As in other production work of similar size and nature, there were "bugs" to remove and set-backs to overcome before the first production estimates were reached, but at present the work is being produced on a smoothly-operated schedule in uniform order and with practically no trouble due to machining methods or tooling. The limits of accuracy required, shown in the drawing of the part, Fig. 1, are strictly held so that by their maintenance the assembling work is greatly simplified.

The first operation performed on the housing is the milling of the bottom and two sides on an Ingersoll milling machine. Two pieces are placed in the fixture, Fig. 2, and are held by eight clamps and supported by adjustable rests so the casting can be lined up in relation to the surfaces to be machined, with an assurance that sufficient stock will be removed. The rough cut is taken first after which the cutters are repositioned and the finish cut is taken on the reverse travel. The sides are machined to 18.5 $\pm$ 0.004 in. and are checked by a snap gage having these limits. One 20-in. and two 12-in. cutters are used, running at 520 ft. per min. with a feed of 0.056 in. per revolution for roughing and a feed of 0.12 in. for the finish. At the next operation, the bottom- and rear-cover pads are milled on an Ingersoll milling machine, shown in Fig. 3. Two pieces are clamped in the fixture and the previously milled surfaces are used for location. The rear-cover pad is milled to 13.031 $\pm$ 0.005 in. from the opposite face, the size being checked by a limit snap gage. The cutters

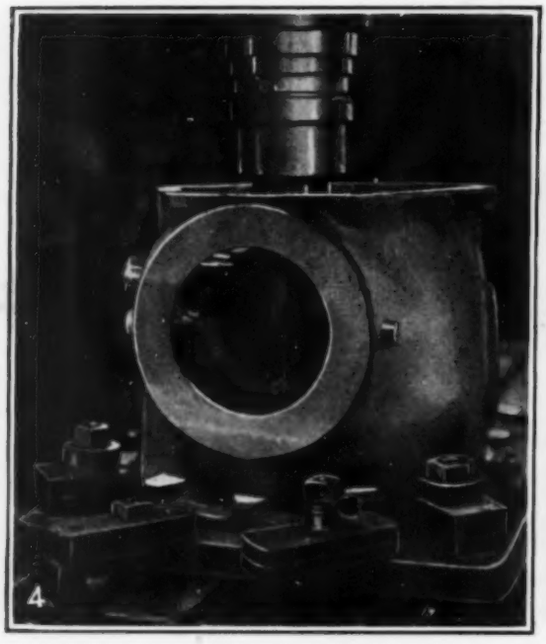

Fig. 4—Milling top of bearing-cap bosses. Fig. 5—Facing top of bosses

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used are of the inserted-blade type and operate at 9-in. table travel at 520 ft. per minute.

The work is then set up on a Cincinnati milling machine for the milling of the top faces of the bearing-cap bosses, Fig. 4. The piece is located from the bottom face and is held by three strap clamps. The cutter, placed through the opening in the upper part of the work, is set to the proper depth and locked. The table is moved so that the four bearing-cap bosses are ma-

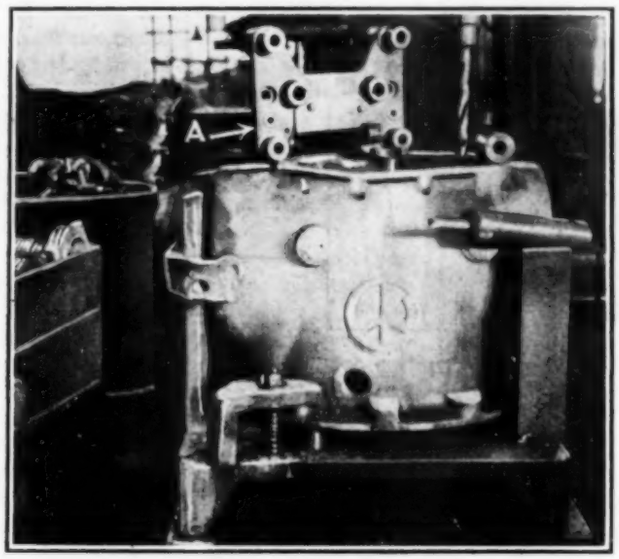

Fig. 6—Drilling and tapping four bearing-cap holes

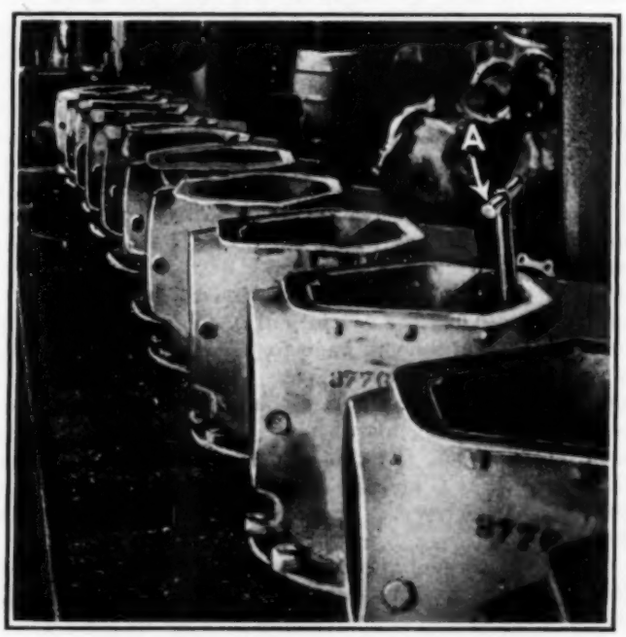

Fig. 7—Assembling bearing caps

chined. The cutter is then reset for the finish cut that is handled similarly. The cutter, of the inserted-blade type, may be seen through the end hole in the illustration. The surface of the cut is made to 7.781 ± 0.002 in. from the bottom side. A height gage is used for checking this measurement. The cutter, 8½ in. in diameter,

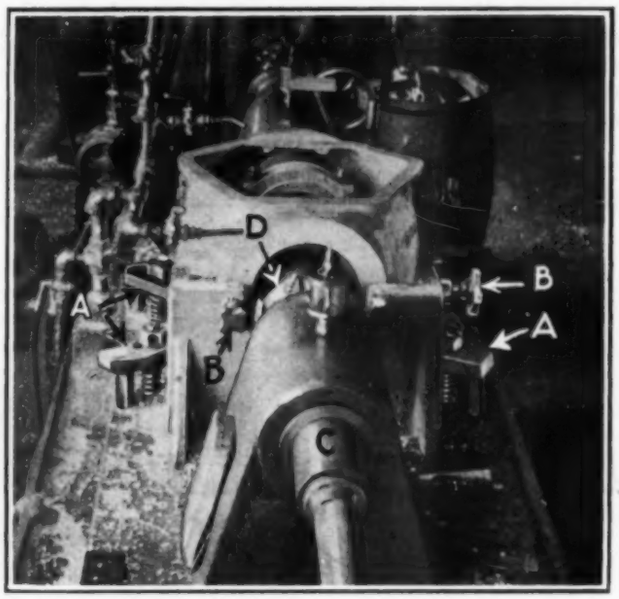

Fig. 8—Boring and reaming bearing holes

is run at 980 ft. per min. with a 0.024-in. feed, with exception of the corners that require hand-operated feed.

Operation 4 is the facing of the bosses on a Lodge & Shipley lathe shown in Fig. 5. The work is located on the face plate of the machine and strapped in position by a C-clamp. The tool *A*, held in the toolpost, is operated at 0.038 in. feed per revolution with a maximum peripheral speed of 257 ft. A rope hoist is used for loading the work into place.

Drilling four ⅞-in. holes, 1⅛ in. deep, and tapping them to 0.742 in.-10 threads, is operation 5, illustrated in Fig. 6. The work is clamped in a fixture, on a Cincinnati-Bickford radial drill, that has a loose plate-jig *A* attached in position over the bearing-cap bosses. After the holes have been drilled, the jig is removed and the holes cleaned out by air pressure, after which they are tapped to size. Four studs, dipped in white lead, are started by hand and driven in place by a stud driver

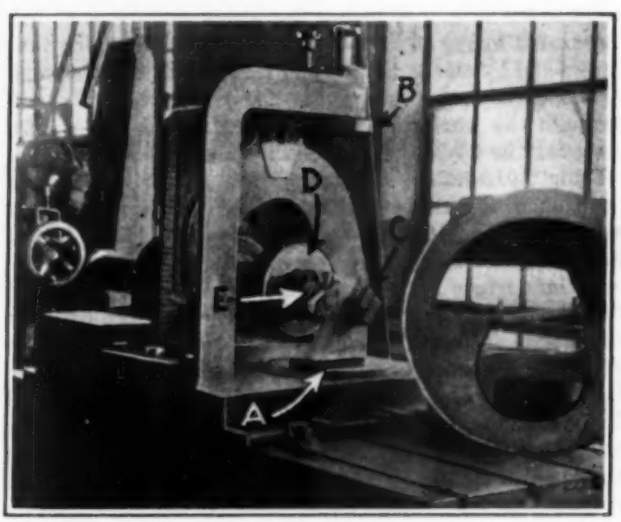

Fig. 9—Boring 8½-in. hole and facing inside surface

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held in a Magic quick-change chuck, completing the operation. The drills operate at 390 r.p.m. with a feed of 0.005 in. per revolution and the studs are driven in at 390 r.p.m. A thread gage is used for checking the size of the threads.

The method of assembling the caps is shown in Fig. 7. Twelve pieces are mounted on a special bench with the caps, two for each housing, set alongside. A serial

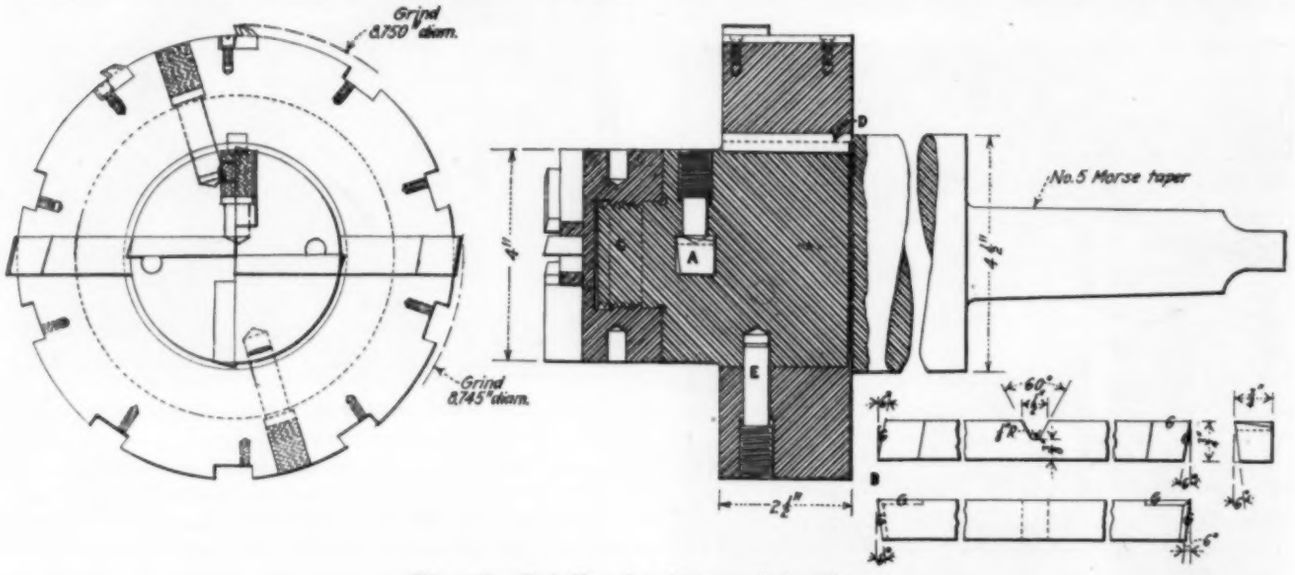


Fig. 10—Details of cutter used in Fig. 9

number is stamped on the three parts for further reference and identification purposes. All burrs are removed, the bearing surfaces cleaned, the studs tested for looseness, straightened if required, and the caps put in place. A washer is placed over each stud and the nut is screwed on, being tightened by a socket wrench shown at *A*. The position of the caps may be seen in some of the succeeding operations.

Finishing the Bearing Holes

Operation 7 is boring and reaming the large bearing holes to 6.9988 to 7 in. and the smaller bearing hole to 5.374 to 5.375 in. and facing the inside surface to 6¾ in., illustrated in Fig. 8. The work is located on the bottom flange and by one end, and clamped by four strap-clamps *A* and three screw clamps *B*. The boring bar *C* is slid through the work and into it are fastened two boring tools for the 5¾- and 7-in. holes. These holes are bored, leaving 0.015 in. for the finish. The larger tool is then positioned for the other 7-in. hole which is likewise sized. The boring tools are removed and the facing head, for one side of the bearing, is fastened in place and the surface is faced, after which it is removed and the other side is completed, so that the distance between the inside faces of bearings is 6.740 to 6.760 in. Two reamers, such as shown at *D*, are then assembled on the bar so that one 7-in. and the 5¾-in. holes are finished to size. The larger reamer is then placed at the other end of the bar for the remaining large hole, completing the operation. A soda-water compound is used as a coolant for the various tools. The boring tools operate at 230 ft. per min. with a feed of 0.014 in. per revolution and the reamers are run at 80 r.p.m. with a feed of 0.005 in. The operation is handled on a Rockford horizontal drilling machine. Two plug gages for the bores and a width gage, made to the limits specified, are used for checking the work.

The housing is then taken to a Barnes horizontal-boring machine, for the boring and reaming of the 8.7485- to 8.75-in. hole and the facing of the 4-in. diameter surface, as shown in Fig. 9. The work is located in the fixture by one of the large bores, finished in the preceding operation, on the locating part *A* and a similar part *B*. The latter is registered by a handle in the bore on the opposite end. Two hook bolts *C* are used for holding the work in place. The boring bar is first fitted with a boring tool for the large hole so that 0.015 in. is left for reaming. The cutters *D* and *E* are then assembled to the bar for the finishing of the bore and the facing of the inside surface. The reamer has ten inserted blades and the facing head has two. The speed of the boring tool and reamer is 455 ft. per min. and the feed 0.008 per revolution. A plug gage is used for the bore and a depth gage for the 4-in. surface that is checked from the flange face. Details of the reamer and facing head assembly are shown in Fig. 10. At *A* is shown the boring tool in place while at *B* is a detail view of the tool. The facing head is fitted to the threaded end at *C* and the reamer is held in place by a key *D* and tit-screw *E*. The overall length of the bar is 28 inches.

The eight foregoing operations take the housings up to the point of drilling the stud holes on the outside of which there are forty distributed on four of the faces.

The jig to hold the work for this operation will be illustrated and described in detail in the next section of this article. The method used in driving the studs will also be described along with an outline of the inspection procedure and the gages used in checking.

Every effort is made to check performance as the work proceeds and to catch errors at the start.

(To be continued)

Those New Superintendents

By J. E. Dykstra
Factory Manager, Champion Chemical Co.

WE HAVE all seen at one time or another a new manager or superintendent come in and we have heard the usual run of comments going through the factory, as to whether or not he is going to make it or whether he is going to fail inside of six months or a year. I have wondered often as to the necessity for these comments and it has always been of more than passing interest to me as to just how much the managers themselves were responsible for this gossip.

There is, of course, considerable difference between superintendents or factory managers—it seems to me that they in general may be classified into three groups.

To use a modern expression, the one group would be classified as modernist and the other as modern-fundamentalists and the third as fundamentalists pure and simple. The third group is on the whole quite negligable and we shall therefore leave them out of this discussion.

The second group is the most important of the two groups and this group is about the saving grace of industrial activity. They are, the writer believes, in the great majority. To this group belong the men that know how to analyze instead of jumping to conclusions. They are the men that realize that there is in all probability a good reason as to just why certain things are performed in a seeming obsolete manner; and they know human nature well enough to obtain the reason before they condemn. They will suggest to the department head and the employee that better results may be accomplished or the same results with less expenditure of effort and time. They are the leaders and not the drivers of industry. They hold together all that is good in the old organization and they use this as a nucleus around which the new organization is to be molded and to function. Remember however, that under men belonging to this group the new organization will come about surely, though slowly enough to keep the old organization from wondering as to whether or not all the brains pertaining to their business have been bestowed on one individual.

Contempt for the Know-It-All

The manager belonging to what the writer has termed the modernist group, is the man who wants to know when he sees an operation performed in a seeming obsolete manner as to, "Wyinell do you do that this way?" He orders the individual to cease operating in this manner without frequently even consulting either the department foreman or the operator himself and then proceeds in another high-handed manner to order the work on hand done in a different manner.

It is just possible that the department head will protest in a feeble manner and try to explain as to why he had it done in the manner that drew the ire of the new manager. Quite likely he will be told that was all right under the old regime but we are going to do things our way now and he is probably dismissed with the gentle hint that he might as well fall in line. The news travels through the factory the same day and the whole organization is expectant and uneasy. Every thing goes well until the new manager goes wrong in his snap judgment, and once more the news travels that, "He did not know it all," and respect is tempered with contempt. Soon a department head makes up his mind that he might better seek employment elsewhere that is more congenial and word is passed from the manager's office that he can quit if he wants to, he, the manager, can obtain plenty of men more capable than the foreman who is leaving from his old factory.

From then on, co-operation on the part of the organization is faint-hearted and the manager is possibly better off, could he but dismiss the whole organization and bring in the one he had previously worked with. It is difficult for him either to lead or to drive the old organization.

The writer has always been mindful of what he heard an old machine shop foreman say some fifteen years ago when he was discussing the fact that he had worked in that particular plant as machine shop foreman under fifteen different superintendents. It was the significant statement that all managers might well think about, "I sometimes wonder as to how we ever existed this long or happened to get by; as every one seems to find what was done by his predecessor to be all wrong." Is it any wonder that the question is sometimes asked as to what is wrong with the management of our industries? The writer believes that it can be invariably answered that there is too much one-man stuff and not enough organization effort and too little appreciation of previous managerial effort. The modernist, so called, is too much obsessed with the idea that if the efforts of the previous manager had been worth preserving he would still be on the job. The result, too often manifests itself in a lack of co-operation, which is so essential to our modern industrial condition.

Blessed therefore is the firm whose new manager belongs to the modern-fundamentalists, because he shall shortly be known by the more or less affectionate term of "old man" and when this term is once applied, co-operation of the whole organization is usually assured.

Six Opinions on Dimensioning Drawings—Discussion

By Walter W. Mohr
Chief Draftsman, The Edward Valve & Manufacturing Co.

I JUDGE, from reading the article which appeared under this head on page 259, Vol. 63 of the *American Machinist*, that the original request for suggestions on dimensioning drawings in behalf of the Ordnance Department has created quite a discussion. Let me add a bit to it.

It is generally understood that no system of dimensioning is absolutely foolproof, and I suppose, with the help of a half dozen printed books of rules, that a mechanic would be able to finish a piece of work as described on page 259, where is shown an Ordnance-Department drawing.

Instead of criticizing this particular drawing with all of its red tape, I wish to take exception with Harvey S. Pardee, page 261, Vol. 63, when he says that the drawing of the cam shaft is a practical working drawing. In my eyes the weakness of this drawing which is reproduced for reference is more noticeable since I am engaged in an altogether different line of business.

Being a practical machinist I would have to ask several questions before I would be absolutely certain of getting the piece of work right. To illustrate my point

I have placed letters on Mr. Pardee's drawing, as shown, and will refer to them. How should I know, for example, what diameters *A*, *B*, *C* and *D* are? I presume they should be $\frac{7}{8}$ in. but I could not be positive. The same holds true with the small radii on the different cams.

From the viewpoint of executing a practical working drawing, I have the following comments to make. Why put the view *E* on a working drawing? It means nothing to the machinist. The $\frac{3}{8}$-in., 18-U.S.F. thread should be dimensioned for the bore, otherwise the man on the lathe will spend good time in figuring it himself. If centers are to be kept in the finished piece it should be shown with a note and not by drawing it in without dimensions. No diameter is given on the undercut at *F*. If a sharp corner is desired at *G*, it should be done by making a slight undercut, since the tool cannot cut it. The No. 5 key should be more specific, such as Woodruff key, or if special, this should be noted. Since the drawing allows $\frac{1}{64}$ in. tolerance the keyway could be too wide or too narrow for a good fitting key. The best way would be to mention the number of the milling cutter to be used.

A minute or so spent in making the drawing clear may save fifteen in the shop. A mechanic hates to ask the boss for information, he will talk it over with his fellow workers first. This method clearly leads to arguments and, by getting out handbooks and tables, valuable time is lost. It finally ends up by asking the foreman after all.

The $\frac{11}{16}$-in. dimension at *H* should be given as $\frac{43}{64}$ in. from the shoulder since an undercut is not accurate enough to be dimensioned from. A dimension should also be given at *K*, since this is the first shoulder to be turned down from the left hand at *L* for the second shoulder, and the length of thread including height of undercut *M* should be given, since this is the third shoulder to be turned down. To give an undercut as depth is not as practical as showing a diameter which can be measured with a pair of calipers instead of using the scale that does not get close enough to the shoulder.

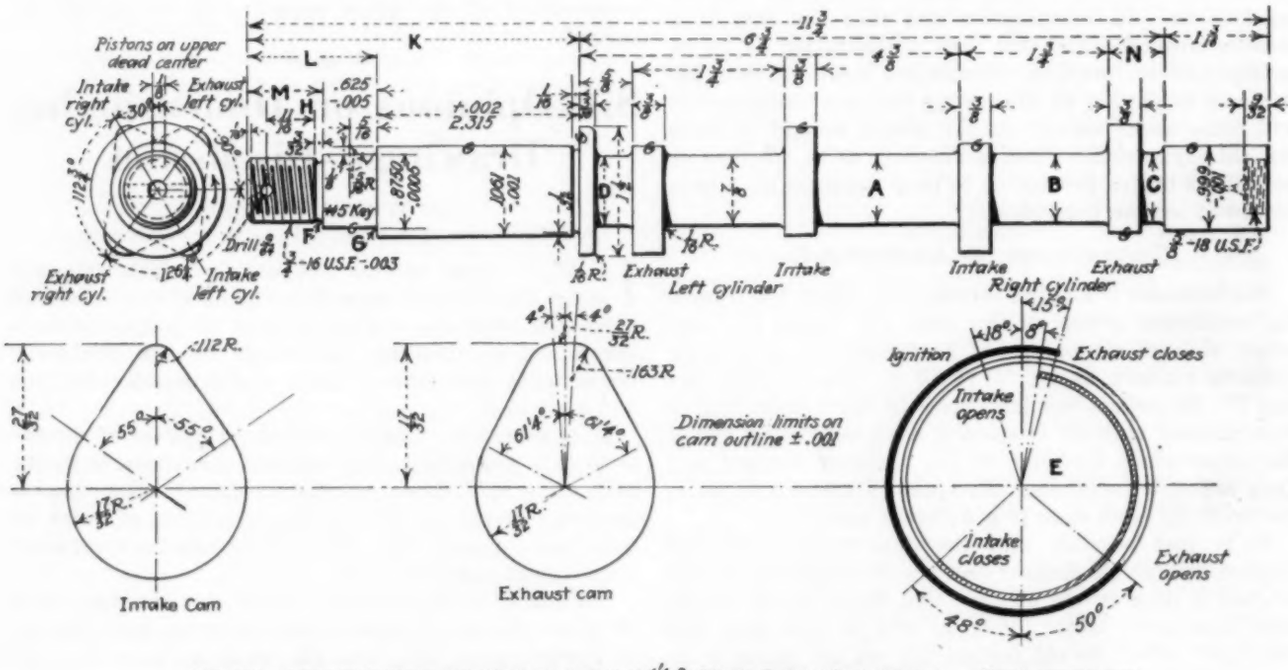
A dimension at *N* would give the workman a chance to check up and I do not believe that it would clutter up the drawing. The faces to be ground are marked *G*, but nothing is said about how much to allow for grinding. All other finished faces are not indicated and the mechanic would be justified in leaving them without finish.

I do not criticize the legend, but a standard title with a drawing number would be in order on all drawings. Any description besides the title should be fitted to the individual requirements of the plant.

The writer believes that the best way of making working drawings would be to furnish one for each department, say pattern shop, forge shop, machine shop and assembly room. Each drawing would then have only the dimensions required in that particular department, but since this method would be too expensive for most plants, we have to make the best of it by making clearly defined drawings which leave no room for questions in the shop.

The foreman should study the drawings carefully before giving them to the men in the shop, so that all questions are paid out of the overhead instead of the profits.

It is the writer's sincere belief that before standardizing drawings in this country, the metric system should be adopted first. The United States and Great Britain are the only remaining nations to fight with an absolete and cumbersome measuring system.



ALLOWABLE VARIATIONS ON FRACTIONAL DIMENSIONS PLUS OR MINUS 64 ON DECIMAL DIMENSIONS PLUS OR MINUS UNLESS OTHERWISE NOTED

DRAWN H.D. 7-11-19	CHANGES	WAS	O.K.	CAM SHAFT	WORK LOCAL CASE HARDEN CAM & BEARING SURFACES	PART NO. 5311
TRACED L.E.B. 8-12-19	A			USED ON 5 KW. PLANT	MATERIAL 1020-STEEL	DATED
CHECKED	B			NO. WANTED ONE	SIZE / SHAPE	FILE
APPROVED	C			THE AUTOPLANT CO.	DIE OR PATTERN NO.	REPLACES
	D			MILLER & PARDEE-ENGINEERS-CHICAGO	WT. STOCK / WT. FINISHED	REPLACED BY
	E					
	F					
	G					

The working drawing

Press Tools on a Production Basis

By W. E. Irish
Associate Editor, *American Machinist*

Equipment and facilities for toolmaking in a modern pressed-steel plant—Layout of the department—Standardization of parts—Distribution of work—Points of design

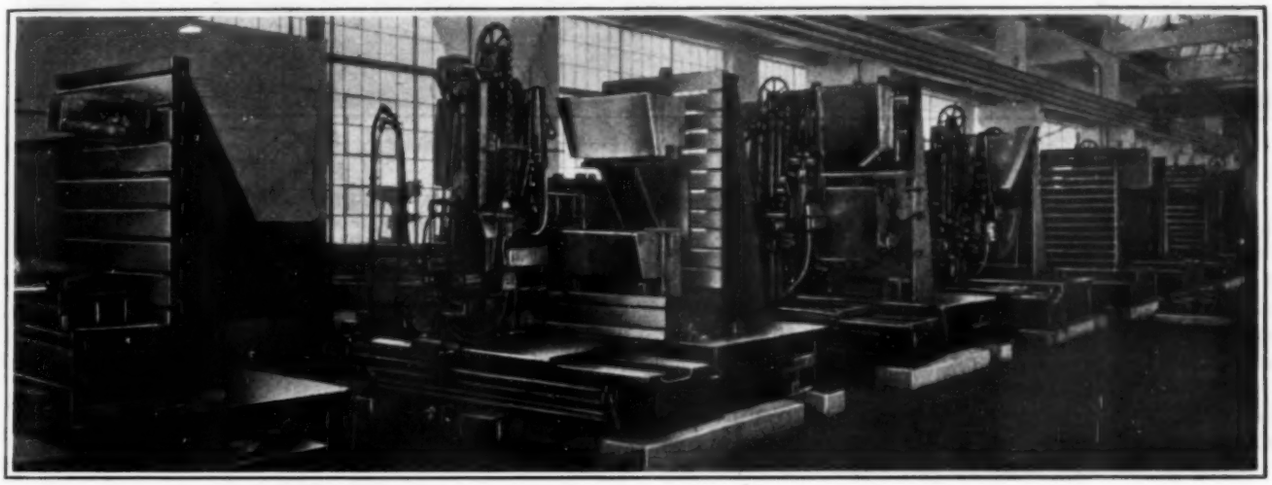


Fig. 1—The group of Keller mechanical engraving machines on the sixth floor

GIVEN buildings, machines, materials and men, success in the manufacture of most products, other than pressed steel, is a matter of applying the correct direct production methods. In the art of pressed steel, there is another factor which is just as important, if not more so, than any other one item. That factor is tools, press tools, where design, manufacture and handling are deciding influences. Pressed steel is primarily a business of tools, after which the finished product will materialize as a matter of strokes of the press.

The point is illustrated and the extent to which one manufacturer has refined the heart of his pressed-steel business is emphasized by a description of the equipment provided, the basis of tool design, the tool manufacturing organization, the procedure followed and the control of the finished tools in the Edward G. Budd Manufacturing Co. of Philadelphia, Pa., makers of automobile pressed-steel bodies among other pressed-steel products.

At various points in the plant there are departments given over to the manufacture and maintenance of tools, but this article is confined principally to the two main ones, where the bulk of the body tools are constructed and kept in repair, together with the facilities provided for storage and handling.

The original tool-manufacturing department is located on the first floor of the six-story main building and the other, where eventually all of the work will be combined, with the exception of the very heavy dies and the repair work, is located at one end of the building on the top floor.

In the combined repair and new-die department on the first floor there are some 40,000 sq.ft. of floor space which is divided approximately 65 per cent to die maintenance, 30 per cent to new tools and 5 per cent between the templet-making section and the offices. On the sixth floor, the department has approximately 32,000 sq.ft., all of it devoted to new work and divided to give some 30 per cent to machine equipment, 60 per cent to floor work and 10 per cent to jigs. The division between space for floor work and machine installations on the first floor is in practically the same relation as on the sixth.

A short time hence, perhaps, will show changes in the methods of manufacturing dies for press work where there are many irregular shapes and deep cutouts from the solids, but in the present day the installation of appropriate mechanical equipment is a good indication of the progressiveness of the company manufacturing any quantity of this class of press tools.

In Fig. 1 is shown a line of eight Keller full-automatic die-sinking machines standing side by side. All of them are worked full time, and in order to meet the production demands imposed upon them, an extra templet-holding angle plate is provided for each machine. The next jobs are set up on these plates without disturbing the work being done at the time on the machine.

This is the first of three articles on equipment, organization, and procedure in manufacturing press tools on a large scale. The second will appear in an early issue.

Fig. 2—The set-up of planers on the sixth floor

The amount of time required to complete a die on the Keller machine depends largely on the finish desired and the size of the corresponding cutter tools. While it is the intent, therefore, to complete each die before taking it from the faceplate, there are times when the hurry for another tool makes it necessary to do a certain amount of final finishing by hand.

In arranging the machine equipment, the company found it advantageous to group work of a given nature, which explains the lines of similar machines to be seen in both of the tool departments. The line-up of the Kellers was by no means haphazard.

Across an aisle, as shown in Fig. 2, is a row of eight planers, all of which are kept busy on the work for which they are intended. At the end of this line, but not included in the photograph, are five lathes.

There is another aisle in front of the planers, and then a row of seven milling machines, four of the vertical type and three horizontal, all Cincinnatis. Working space is allowed around and in front of these machines, and then comes a final line of thirteen Gould & Eberhardt 32-in. shapers facing a bench built along the wall. The set-up of the milling machines and the shapers is illustrated in Fig. 3. At the end of these lines, but again not shown, come two Dill slotters which complete the main machine grouping in this part of the department.

In Fig. 4 is given a view of part of the floor-work section, where the parts from the machines are assembled and fitted. Distributed through this section, convenient to the workers, there are ten drilling machines, plain and radial, of various capacities and makes. Three floor grinders are also located to the best advantage.

At the end of the floor-work section, and at the opposite end to that occupied by the machine tools, there are three fitting-up presses of the same general design as illustrated in Fig. 5. These machines are of home design to meet the company's particular requirements.

Finally, at the same end of the department, the extreme end shown in Fig. 4, there is a small blacksmith set-up to serve the needs of the toolmakers in the department.

By way of summary, the following list is made of the machine equipment on the sixth floor:

Machine-tool equipment on sixth floor

Machine tools	Capacity	Number
Drills, radial	5 ft.	3
vertical	8 in.	1
	10 in.	3
	12 in.	1
	24 in.	2
	28 in.	3
Engraving machines	6 ft. x 31 in. x 15 in.	8
Grinders	18 x 24 in.	1
	18 x 48 in.	1
	18 x 54 in.	1
Lathes	16 in. x 6 ft.	2
	16 in. x 8 ft.	1
	18 in. x 8 ft.	1
	24 in. x 10 ft.	1
Millers, horizontal	10 x 24 in.	1
	18 x 40 in.	2
	10 x 24 in.	1
	12 x 24 in.	1
Planers	28 in. x 8 ft.	1
	30 in. x 8 ft.	1
	36 in. x 10 ft.	2
	48 in. x 10 ft.	2
	48 in. x 12 ft.	2
Shapers	20 in.	1
	32 in.	13
Slotters	10½ in.	1
	18 in.	2

As can be seen in the illustrations, all the floor space is located under three craneways, the crane equipment being of the type that is operated by pull cords extended to the floor. There is practically no heavy lifting and hauling done by hand or man power.

In general, the department is clean and orderly. There is a decidedly unobstructed atmosphere, due to the absence of belts and countershafts, with each machine individually driven and all of the drives inclosed or guarded. Provision is made for the storage of tools

and parts for the machines in substantial pressed-steel cabinets set adjacent to each unit.

Careful operation, with a thought to maintenance by prevention, is indicated by the fact that ample quantities of oil were coming from under the guides of the planers, which had systems of forced feed lubrication, and that the central lubricating system on each of the Gould & Eberhardt shapers registered full, or nearly so. The company has long realized that the greatest proportion of worn-out machine parts invariably starts with lack of lubrication and is now demanding adequate lubrication when new equipment is purchased.

On the fitting-up presses there is a good deal of grinding to do, and cuttings from the wheels are shot against the ways on each side of the housing. To protect these ways, there are two roller curtains, one on each side, of heavy rubberized material attached to the ram, as shown in Fig. 7. When grinding is to be done, these are pulled down between the ways and the action of the grinding wheel.

Another point that has an important bearing on maintenance is the prevention of chips from falling into the planer ways from the planer tables. This point has been taken care of in a simple manner, as can be seen in Fig. 2. by attaching a sheet-steel deflector on the end of each table to direct the chips to the floor, away from the ways.

In the first-floor tool department there is a similar arrangement of machine-tool floor space divided between new and repair work. The following equipment summary shows the division of machines between these two classes of work:

Machine-tool equipment on first floor
For new-tool work

Machine tools	Capacity	Number
Boring mills, horizontal	4 ft.	1
	6 ft.	1
vertical	6 ft.	1
Drills, radial	6 ft.	3
	7 ft.	1
Drills, vertical	8 in.	2
	10 in.	3
	12 in.	2
	24 in.	2
	28 in.	1
Grinders	16 in. x 4 ft.	3
	22 in. x 7 ft.	1
	28 in.	1
Lathes	14 in. x 4 ft.	1
	16 in. x 6 ft.	1
	16 in. x 8 ft.	1
	18 in. x 4 ft.	2
	18 in. x 6 ft.	1
	18 in. x 12 ft.	1
	24 in. x 6 ft.	1
	38 in. x 10 ft.	1
Millers, horizontal	18 x 40 in.	2
vertical	10 x 24 in.	1
	12 x 24 in.	1
	18 x 40 in.	4
Planers	36 in. x 8 ft.	2
	48 in. x 10 ft.	4
	60 in. x 14 ft.	1
	72 in. x 12 ft.	1
Shapers	16 in.	1
	20 in.	5
	24 in.	7
	32 in.	2
Slotters	18 in.	1
	24 in.	1

This list, as the heading indicates, shows the lineup of equipment for doing new work in addition to that carried on in the sixth-floor department. The total, here, of 64 machine tools added to the 59 located on the sixth floor makes a total of 123 tools. Truly an imposing array and particularly so when it is considered that none of

Fig. 3—View of the shapers and milling machines and part of the planers in the sixth-floor department

them are in poor shape or of obsolete design. Each one gives the impression of careful attention by the operators.

For tool-repair work on first floor

Drills, radial	5 ft.	1
vertical	6 in.	1
	12 in.	1
	21 in.	2
	24 in.	1
Grinders	22 in. x 7 ft.	1
Lathes	14 in. x 6 ft.	1
	20 in. x 6 ft.	1
Millers, vertical	18 x 40 in.	1
Planers	48 in. x 10 ft.	1
Shapers	20 in.	2
	24 in.	2

These lists, in connection with the summary for the first department described, give a fair idea of the length to which the company has gone to provide adequate facilities for efficient and prompt press-tool manufacture and upkeep.

An important point, and one worth repeating, is that there is not an old or obsolete item in either of the departments.

An arrangement is made whereby excess work, that may be ahead of the repair section, is taken care of as necessary on the new-tool machines in the first-floor section.

The design of the tools and the equipment just enumerated fits nicely together to work toward economical manufacture, a minimum of maintenance and the availability of those parts for replacement which are the most subject to wear.

Before going into the discussion of design, methods and procedure, another of the company's departments should be mentioned briefly by way of obtaining a better understanding of the groundwork on which the three rest.

An efficiency department, which has headquarters in the main office, has been organized for some time to co-operate with the pressed-steel division in a number of directions. One of these is standardization of parts and methods to as complete an extent as possible. To this end, the tools have been divided into their component parts, and the department has made a study of sizes, designs and types.

From this study a standards book has been started and is being augmented with further design standards as new and better methods are worked out. The result has been two-fold.

Taking guide pins as an example, it was found that initially there were between 35 and 40 sizes and that material for each was carried in stock. The pins were made as each new set of tools required them.

It was found possible to cut the sizes to 10 and to standardize so that this number can be made and carried in quantities in stock. A copy of the book of standards is furnished the shop and another to the drafting room, so the standards may be used to save time, on the one hand, and to obviate departure, on the other, from practices that have been found the most economical.

When a tool is to be started in the machine shop, standard guide pins are furnished as a part of the bill of material and come with the other unfinished parts from the stores and materials division. The machinist draws a standard counterbore from the toolroom crib that will produce a hole with the correct drive fit and makes the holes to the pin rather than the other way around, as was the previous custom.

Die steels, and in fact the entire steel-stock situation, were carefully gone over and standard ranges of sizes determined on and tabulated for the standards book. The investigation resulted directly in greatly reducing the materials-on-hand inventory.

The present standard calls for tool-steel rounds in size steps of $\frac{1}{8}$ in. up to 2 in., $\frac{1}{4}$-in. steps to 3 in., and $\frac{1}{2}$-in. steps to 6 in., the maximum round size carried. Squares are carried in the same sizes to a maximum of 5 in. Flats vary in thickness by $\frac{1}{8}$-in. steps to $\frac{3}{4}$ in., by $\frac{1}{4}$-in. steps to $2\frac{1}{2}$ in. and by $\frac{1}{2}$-in. steps to the maxi-

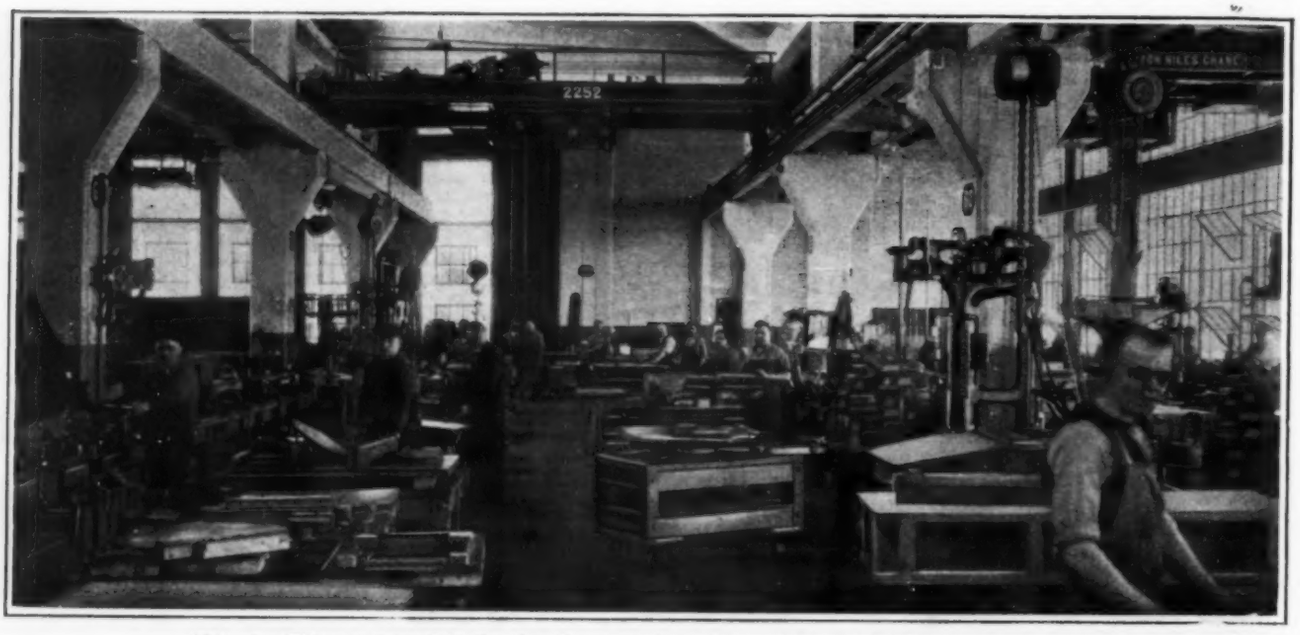


Fig. 4—The center aisle in the floor-work section of the sixth-floor department

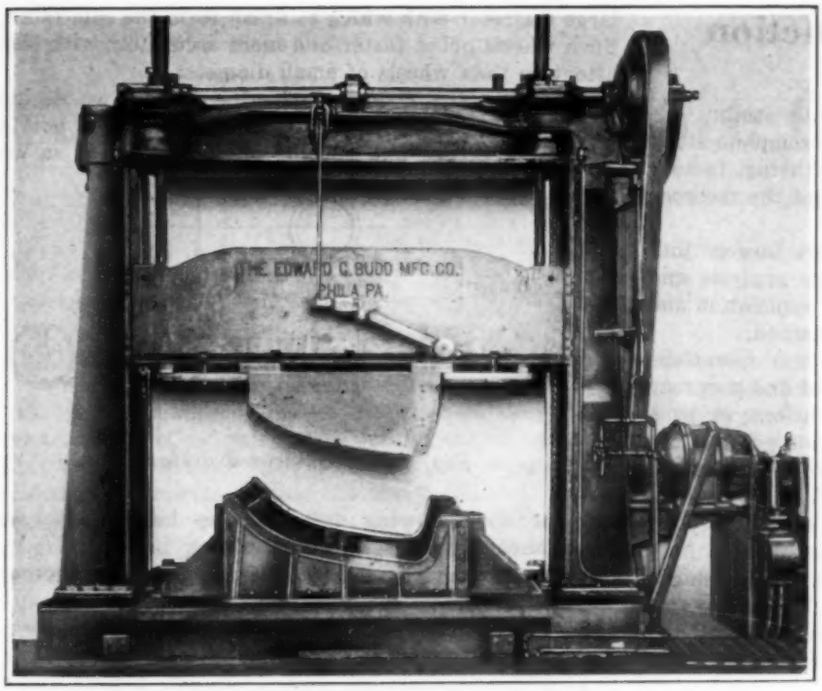


Fig. 5 One of the fitting-up machines with a die in place ready for checking

mum of 4½ in. The widths runs by quarters to 1 in., by halves to 4 in. and in 1-in. steps to a maximum of 8 in. This maximum width holds only on one thickness size, 1½ inch.

When it is stated that over 30 per cent of the original sizes were cut out, the saving in inventory can be appreciated.

On many of the dies, particularly those for blanking, the construction calls for backing up the steels in the die casting, which requires shouldering the die block, often on irregular outlines.

It has been found that work of this nature lends itself readily to a milling operation, which accounts for the installation of the milling machines.

The die steels themselves are machined to the best advantage in the battery of shapers, which can be used rapidly and flexibly in shaping the parts, following the outlines laid out for the cutting edges. The shapers are, therefore, employed on all of this work within their range. There is a good deal of it, as attested by the number of machines in use.

The longer straight cuts, flat-surfacing and outside-shoulder work are made in the planers, while the slotters are used when a horizontal shaper cut would require an unwieldy vertical set-up.

The engraving machines have replaced the hand efforts of many men on the work involving die sinking and finishing of irregular surfaces. They have made exact fits in solid forming punches and dies both possible and economical. In fact, sectional dies, which in many cases would have to be resorted to without the engraving-machine installation, would be prohibitively expensive and would tend to leave marks on the products at the intersection of parts, which in the fine pressed-steel bodies turned out by the company could not be tolerated.

Cast iron has been found to operate most satisfactorily on many of the forming operations, as it does not tend to cut or leave marks on the steel products. It is, therefore, used wherever possible. Hardened-steel inserts are employed where necessary on edges subject to severe wear and on bottoming points where sharp outlines, like ribs or dead-square corners, must be formed.

The attempt is made to shape wearing edges on the draws so that cast iron can be used without bad effect on the piece.

Hand clamps are employed at numerous points to confine the relatively thin metal, of which the bodies are made, to supplement the action of the blank holders on the double-acting presses.

Very satisfactory results have been obtained by the installation of Marquette blank-holder pressure equalizers on some of the large Toledo forming presses.

At certain points of the draw, as in unsupported ends and in corners where excessive wrinkling is apt to occur, it is necessary to pinch the work and offer more resistance to the draw than at other points. This is accomplished by making a depression in the surface of the die over which the metal has to draw and a corresponding rib in the blank holder that will register in the depression and force the metal to pull under it as it is drawn down into the form.

Die steels and steel parts are secured to the cast-iron holders by means of fillister screws with safety-setscrew heads. This type of screw lends itself to better advantage for tightening and loosening than does the usual fillister-head screw, particularly when work has to be done on the tools in the press. Each workman who has to do with making and repairing the dies is provided with a set of the wrenches.

There are many other refinements of tool construction, and many intricate die designs that have been worked out. Suffice it to say here that there are very few opportunities overlooked and every effort is made to design and build press tools that will render continuous, satisfactory service. Certainly, the array of equipment for die making indicates the company's sound belief in providing every up-to-date facility to assist in performing the work in an up-to-date manner.

Guiding the Suggestion System

It is decided to start a suggestion system with the company's employees. Plans are drawn up, awards are settled on, and the starting announcement is made.

Things go along nicely. A good many men respond and the company is able to put a number of suggested points into effect to advantage. Awards are made and everyone is pleased with results until shortly the suggestions stop coming in. Everyone has run out of ideas.

The cause is sought for and usually not being actually found is attributed to lack of interest for one reason or another. The real cause lies in the fact that a suggestion system needs a leader just as much as any business. Some one who can guide and direct, who can think of and publish concrete points on which to make suggestions, points that will give potential suggesters the necessary something definite to work on.

Analyzing for Production

By W. B. Gardiner

TO ANALYZE is to make a minute study. To analyze for production is to make a complete study of all of the details employed in manufacturing, factory methods, cost and production systems and the methods of applying and handling them.

The cost and production system enters largely into carrying out the plans derived from the analysis and requires close attention to the method of application and operation that the full benefit may be obtained.

In analyzing manufacturing methods and operations we find that very often time can be saved and accuracy established by the addition of new operations, or by a new subdivision of the component parts and possibly the addition of another piece. In illustration of the method of procedure I will take the cam of an adjustable reamer which shows, after an analysis, the advisability of adding another piece and also several operations.

As originally designed we have one piece, as shown in Fig. 1, with these operations.

1—Finish form complete, except undercut, thread and center on hand screw machine.
2—Center other end.
3—Mill adjusting slot in head.
4—Mill cam faces. Use a small diameter cutter in order to mill close to head.
5—Turn undercut.
6—Cut zero line on face of head.
7—Pack harden.
8—Straighten.
9—Grind cam faces.
10—Polish face of bead.

We first get the cost reports of several lots of all parts including the cost of assembling several lots of the complete reamer and analyze them completely from raw material to finished product.

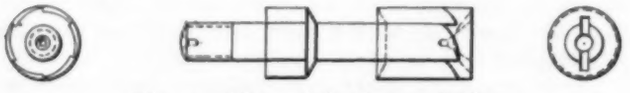


Fig. 1—The original cam design

The operations, at first glance, do not seem excessively high, but the assembling cost shows something is radically wrong for here it is too high. High assembling cost means inaccurate work in manufacturing the parts. Inaccuracy in the parts means bad workmanship, bad fixtures, bad methods, bad design, any or all. The tool must be accurate to be of value as a reamer, and must be interchangeable as interchangeability is a manufacturing necessity as well as a needed quality in the sale of parts for renewals.

A study of the design of this cam shows us that far greater accuracy can be obtained easily and at much less cost by a slight change, Fig. 2, making it in two pieces instead of one.

By doing this we accomplish several things. We are sure of a flat seat for the blade without thought of the diameter of the cam face cutter or the exact length of the cut. It permits the use of medium sized cutters instead of shank mills, therefore we can use multiple spindle fixtures and a gang of mills and mill completely across the cam. This eliminates the hollow caused by pausing at the end of the cut with the milling cutter on the work. It also permits the use of abrasive wheels of large diameter with which to finish form the cam faces. Such wheels grind faster and more accurately with less attention than wheels of small diameter.

Analyzing the manufacturing operations we decide that by grinding to finish size at all functioning points we can save time and get the needed accuracy, so we

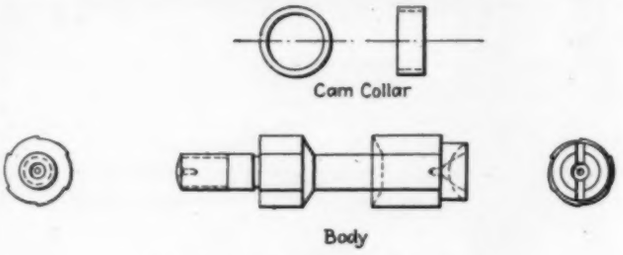


Fig. 2—The improved design

lay out the following operations to be employed in accordance with these new methods:

1—Form complete, except undercut, thread and center on automatic screw machine.
2—Center other end.
3—Mill adjusting slot in head.
4—Mill cam faces on multiple spindle fixture and a gang of cutters.
5—Turn undercut.
6—Pack harden.
7—Straighten.
8—Grind cam faces.
9—Grind undercut.
10—Press on collar.
11—Grind shank to size.
12—Grind head to size.
13—Polish head.

Note—Put zero line on collar at assembly.

It will be noticed that we have added one new part and three new operations, yet the time used in making this cam complete is much less than formerly. This saving of time due to using the automatic screw machine, the multiple-spindle fixture with seven spindles and a gang of seven form cutters, the abrasive wheels of large diameter to form the cam faces and having a reasonable tolerance in the straightening operation, more than saved the cost of the added piece, which was an automatic screw-machine product and its assembly on the cam body itself, together with the cost of the added grinding operations.

Not only have we reduced the cost of manufacture but we have acquired accuracy, an accuracy the old methods could not even approach. We have reduced the liability of rejections at inspection and by the elimination of assembling troubles have greatly reduced the assembling cost.

The last items should be noted carefully for the elimination of scrap very often means the difference between profit and loss. Changing the methods does not necessarily increase production or reduce cost at particular point, but the quality obtained may be effective to a large degree in subsequent operations in there eliminating scrap or saving time.

Therefore we must analyze the design to see if it will permit of the best manufacturing methods being used. We must analyze the mechanical methods and processes to see if changes can be made that will pay for themselves at that particular point or in their affect on subsequent operations or in the elimination of scrap.

Varying-Center-Distance Gears

Calculations for the design of varying-center-distance gears—Methods for avoiding undercutting —Tooth-thickness and pressure-angle formulas

By H. Walker
Yorkshire, England

THE property of varying the center distance in involute gears has rendered them useful for a large number of purposes for which they would otherwise be of no value; but the amount of variation that can be attained has been commonly exaggerated and it is of importance that the designer should clearly comprehend the various factors that govern the design of this type of gear. The present article is intended to illustrate as clearly as possible the most accurate and definite methods of dealing with varying-center-distance problems.

The most reliable method is that of calculating the dimensions of the gears and then making a layout of the teeth so as to obtain a general survey of the profiles. In the case of gears that are required to operate over a large variation in center distance the calculation method is very tedious and sometimes impossible as a practical method, owing to the complications introduced in the design by undercutting, interference and such factors. In this case the dimensions and the shape of profile must be obtained by an enlarged layout, a method of trial and error being advisable. The calculation method is, however, extremely satisfactory for gears with a small variation in center distance and will be dealt with first.

The following notation will be used:

T_1 = Teeth in pinion
T_2 = Teeth in wheel
P = Diametral pitch in closed-center position
C = Closed-center distance
y = Increase in center distance over which the gears are required to operate
D_1 = Outside diameter of pinion
D_2 = Outside diameter of wheel
θ = Pressure angle at closed-center distance
ϕ = Pressure angle at extended-center distance.

The minimum center distance must be

$$\frac{T_1 + T_2}{2P}$$

and the maximum must be

$$\frac{T_1 + T_2}{2P} + y.$$

The cosine of the pressure angle will vary in proportion to the increase in center distance since the base-circle diameters are fixed, so, in Figs. 1 and 2, the pressure angles θ and ϕ must be connected by the equation:

$$\cos\phi = \frac{\cos\theta \times \text{closed-center distance}}{\text{extended-center distance}}$$

$$= \frac{C\cos\theta}{C + y}$$

In order that the gears shall work correctly in the extended position it is necessary that at least one pair of mating teeth shall be in contact at each moment. This will be the case if one pair of teeth are about to come into engagement as the preceding pair are passing out of engagement; that is, the intercept between the corresponding profiles of two successive teeth of the two gears must be equal to or less than the effective length of the line of action. Thus, in Fig. 2, the length of the line MN is less than the full effective length AD,

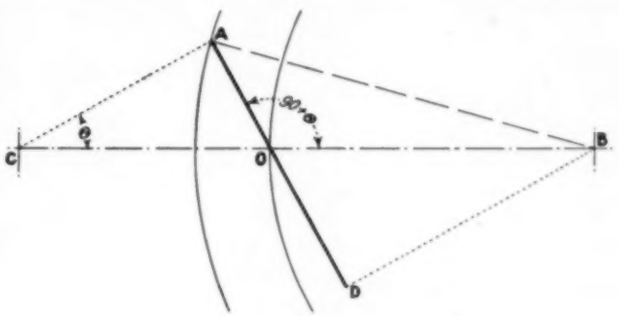


Fig. 1—Wheel and pinion in closed position

of the line of action. It will be obvious that this intercept MN is equal to the pitch of either gear as measured on its base circle. In actual practice it is advisable to make the effective length of the line of action at least 1¼ times this base pitch, or, under the present notation, not less than $1\frac{1}{4}\left(\frac{\pi}{P}\cos\theta\right)$.

The pitch diameters of the gears in the closed position are T_1/P and T_2/P, and in the extended position must be

$$\frac{T_1}{P} + y\left(\frac{T_1}{T_1 + T_2}\right) \quad \text{and} \quad \frac{T_2}{P} + y\left(\frac{T_2}{T_1 + T_2}\right),$$

since they are proportional to their numbers of teeth. The addenda and dedenda of the gears may be varied to give the best results, the pinion having a short dedendum and the wheel a long dedendum. For equal gears the dedenda will of course be equal.

Two methods of dealing with problems of varying-center-distance gears by calculation present themselves. The first is that of making the addenda such that the wheel just avoids involute interference with the root of the pinion when in the closed-centers position, and the second method is to make the distance from the interference points to the first and last points on the line of action when the gears are in the closed position equal in length for the arc of approach and the arc of recess. the other determining factor being that the effective line of action in the extended position is made equal to 1¼ times the base pitch in both methods. The first method is particularly suitable for gears of large ratio since it is the tip of the wheel that first tends to

interfere, and the second method is suitable for gears of moderate ratio in which interference is less likely to take place.

The first method may be applied as follows:

Fig. 1 shows diagrammatically the wheel and pinion in the closed position, *CO* and *OB* being the pitch radii and *DOA* the line of action. Involute interference will take place if the outside diameter of the wheel passes

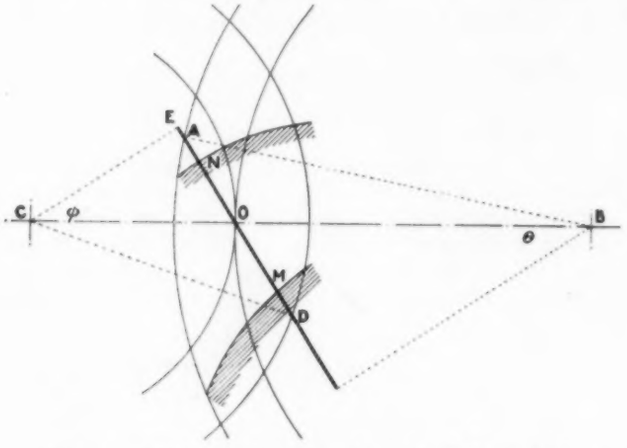


Fig. 2—Wheel and pinion in extended position

beyond the point *A*, and in order to fulfill the condition stated above, the outside radius of the wheel must be made equal to *BA* and may be found as follows:

$$OA = OC \times \sin\theta = \frac{T_1 \sin\theta}{2P}$$

$$OB = \frac{T_2}{2P}$$

$$\overline{AB}^2 = \overline{OA}^2 + \overline{OB}^2 - 2OB \times OA \times \cos AOB$$

Therefore

$$\left(\frac{D_2}{2}\right)^2 = \left(\frac{T_1 \sin\theta}{2P}\right)^2 + \left(\frac{T_2}{2P}\right)^2 - \frac{T^2}{2P} \times \frac{T_1 \sin\theta}{2P} \times \cos(90 + \theta)2 \quad (1)$$

from which D_2 the required blank diameter of the wheel may be obtained.

Fig. 2 shows the gears in the extended position. The effective length of the line of action is *DE*, *D* and *E* being the points where the outside diameters of the pinion and wheel cut the line of action. The length *DE* must be made equal to $1\frac{1}{4}$ times the base pitch, that is

$$DE = 1\tfrac{1}{4}\left(\frac{\pi}{P}\cos\theta\right).$$

The angle *OCA* is now equal to the pressure angle in the extended position and may be found from the equation

$$\cos\phi = \frac{\cos\theta \times \text{closed-center distance}}{\text{extended-center distance}}.$$

It is required to find *CD* the outside radius of the pinion. We have:

$$\frac{AB}{\sin AOB} = \frac{OB}{\sin OAB}$$

Therefore

$$\sin OAB = \frac{OB \times \sin AOB}{AB}$$

Now the angle $OBA = 180 - (AOB + OAB)$

$$= 180 - \left(90 + \phi + \sin^{-1}\left(\frac{OB \times \sin AOB}{AB}\right)\right)$$

$$= 90 - \phi - \sin^{-1}\left\{\frac{(C + y) \times T_1 \times 2\cos\phi}{(T_1 + T_2) \times D_2}\right\}$$

$$= \alpha \text{ (say)} \quad (2)$$

Also $$OA = \frac{AB \sin\alpha}{\sin AOB}$$

$$= \frac{D_2 \sin\alpha}{2\cos\phi}$$

and $$DO = AD - OA$$

$$= 1\tfrac{1}{4}\left(\frac{\pi}{P}\cos\theta\right) - \frac{D_2 \sin\alpha}{2\cos\phi}$$

$$= x \text{ (say)} \quad (3)$$

And $$\overline{CD}^2 = \overline{DO}^2 + \overline{OC}^2 - 2DO \times OC \times \cos(90 + \phi)$$

$$= \overline{DO}^2 + \overline{OC}^2 - 2\overline{DO} \times \overline{OC}(-\sin\phi)$$

$$= \overline{DO}^2 + \overline{OC}^2 + 2DO \times OC \sin\phi \quad (4)$$

In this equation, $DO = x$ (a)

$$OC = \frac{(C + y)T_1}{T_1 + T_2} \quad (b)$$

$$CD = \frac{D_1}{2} \quad (c)$$

This enables D_2, the blank diameter of the pinion to be found. The cutting depth of the gears can then be found from the center-distance and the blank diameters; that is,

$$\text{Cutting depth} = \frac{D_1}{2} + \frac{D_2}{2} = C + \text{running clearance} \quad (5)$$

The tooth thicknesses of the two gears may be adjusted so as to give equal strengths, or if required to be cut by the same generating cutter may be made similar to corrected gears and generated by means of a cutter whose pitch is equal to that of the gears at the small center-distance and whose tooth thickness is equal to half this pitch.

An example will make the method of application quite clear. suppose that it is required to cut a pair of gears

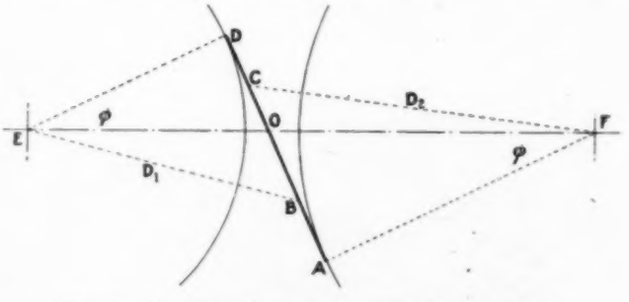


Fig. 3—Layout of gears in extended position

of 30 and 60 teeth to operate at any center distance between 15 and $15\frac{3}{8}$ in. The following table may be made out:

Teeth, pinion $T_1 = 30$; wheel $T_2 = 60$.
Centers, $C = 15$ to $15\frac{3}{8}$ in.
Increase in centers, $y = \frac{3}{8}$ in.

Pitch at 15-in. centers $= \dfrac{T_1 + T_2}{2C}$, 3 *D. P.*

Pressure angle at 15-in. centers, $14\frac{1}{2}°$ (assumed).
Pressure angle at $15\frac{3}{8}$ in., 19° 10′.

$$\cos^{-1}\left(\cos 14\tfrac{1}{2} \times \frac{15}{15\frac{3}{8}}\right)$$

From equation (1) we have:

$$\left(\frac{D_3}{2}\right)^2 = \left(\frac{30 \sin 14\frac{1}{2}^\circ}{2 \times 3}\right) + \left(\frac{60}{2 \times 3}\right) - \left\{\frac{60 \times 30 \sin 14\frac{1}{2}^\circ}{2 \times 3 \times 2 \times 3} \times \cos (90 + 14\tfrac{1}{2}^\circ) \times 2\right\}$$

from which:

$$D_3 = 20.768 \text{ in.}$$

From equation (2) we have:

$$a = 90^\circ - 19^\circ\ 10' - \sin^{-1}\left\{\frac{15.375 \times 60 \times 2 \cos 19^\circ\ 10'}{(30 + 60) \times 20.768}\right\} = 2.03^\circ$$

and from equation (3):

$$x = 1\tfrac{1}{4}\left(\frac{3.1416}{3} \cos \theta\right) - \frac{D_3 \sin a}{2 \cos \phi}$$

in which $\theta = 14\frac{1}{2}^\circ$, $a = 2.03^\circ$, $\phi = 19^\circ\ 10'$
$x = 0.888^\circ$

and from (4, a, b, c):

$$\left(\frac{D_1}{2}\right)^2 = (0.888)^2 + \left(\frac{15\frac{3}{4} \times 30}{30 + 60}\right) + \frac{2 \times 0.888 \times 15\frac{3}{4} \times 30}{30 + 60} \times \sin 19^\circ\ 10'$$

from which, $D_1 = 10.958$ in.

The 3 D.P. pitch diameters of the gears are 10 and 20 and therefore:

Addendum of pinion = 0.479 in.
Dedendum of pinion = 0.436 in.
Addendum of wheel = 0.384 in.
Dedendum of wheel = 0.531 in.

The working depth is 0.863 in. and the hob or rack-type cutter should have a thickness of half the pitch = 0.5235 in. at a depth of $\frac{1}{2}(0.863) = 0.4315$ in. in order to generate conjugate thickness on the gears.

When Ratio Is Low

The second method for gears in which the ratio is comparatively low may be carried out by a calculation from the construction in Fig. 3, in which the gears are represented in the extended-centers position, *O* being the pitch point and *AD* the line of action. The condition already stated is that the line *AB* is equal to the length

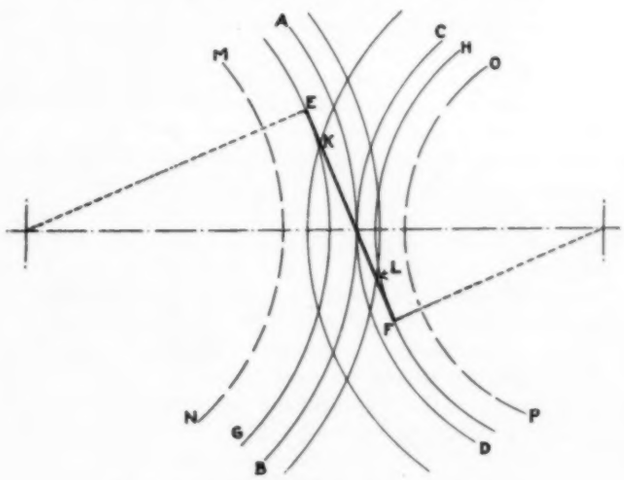


Fig. 4—Method of layout of varying-center-distance gears

CD where *B* and *C* are intersecting points of the outside diameters of the pinion and wheel with the line of action and where *BC* is equal to $1\frac{1}{4}$ times the base pitch of the gears.

We have $AD = AO + OD$

$$= AF \times \tan \phi + ED \times \tan \phi$$

$$= \left\{\frac{(C + y)T_2}{T_1 + T_2} + \frac{(C + y)T_3}{T_1 + T_3}\right\} \sin \phi$$

$$= \left\{(T_1 + T_3)\left(\frac{C + y}{T_1 + T_3}\right)\right\} \sin \phi = (C + y) \sin \phi$$

$$AB = \tfrac{1}{2}(AD - BC)$$

$$= \tfrac{1}{2}\left\{(C + y) \sin \phi - 1\tfrac{1}{4}\left(\frac{T_1}{P} \cos \theta\right)\right\}$$

$$= a \text{ (say)}$$

$$= CD, \text{ also, by assumption.}$$

Now $OB = OA - BA$

$$= AF \times \tan \phi - a$$

$$= \left\{\frac{(C + y)T_2}{T_1 + T_2}\right\} \sin \phi - a$$

Similarly $OC = \left\{\frac{(C + y)T_1}{T_1 T_2}\right\} \sin \phi - a$

Also $\overline{EB}^2 = \overline{BO}^2 + \overline{OE}^2 - 2OB \times OE \times \cos BOE$

And $\overline{FC}^2 = \overline{OC}^2 + \overline{OF}^2 - 2OC \times OF \times \cos FOC$

in which two equations:

$$EB = D_1/2 \text{ and } FC = D_2/2$$

$$BO = \left\{\frac{(C + y)T_2}{T_1 + T_2}\right\} \sin \phi - a \qquad OC = \left\{\frac{(C + y)T_1}{T_1 T_2}\right\} \sin \phi - a$$

$$EO = \frac{(C + y)T_1}{T_1 + T_2} \qquad OF = \frac{(C + y)T_2}{T_1 + T_2}$$

It is obvious that D_1 and D_2 can be found from these equations and the procedure for finding the depths and tooth thicknesses will be the same as in the first method.

The best layout method for gears in which the variation in center-distance is comparatively large is as follows:

A pressure angle at which the gears are to run in the closed position is assumed. For even ratios and moderate numbers of teeth this may be made low, say about 16 deg., while for large ratios it may be necessary to make the pressure angle up to 20 deg. The factors that govern this choice are, first, that a high pressure angle helps to avoid interference and, second, that a low pressure angle keeps the teeth from coming to a point before reaching the required outside diameter. A satisfactory balance between these two factors can only be obtained through trial and error and if the first assumed pressure angle does not give a satisfactory appearance to the gears, the layout must be scrapped and a new angle should be assumed, the first layout giving an idea of the alteration necessary.

Calculating the Center-Distance

Having decided on this initial pressure angle, the obliquity at the increased center distance may be calculated, and the gears may be drawn out in the extended center position as shown in Fig. 4. *AB* and *CD* are drawn to represent the pitch diameters and *EF* is the line of action inclined at the calculated pressure angle. The base diameters *EG* and *FH* are then drawn tangential to the line of action and *KL* the calculated length equal to $1\frac{1}{4}$ times the base pitch, must be positioned on the line of action so that it will give the best results. If *KL* works out longer than *EF* the gears will not work satisfactorily at the large center distance unless the angle of obliquity is increased until the length *EF* is greater than the length *KL*. If the latter is

greater than the former it should be positioned (for the first trial) so that *EK* is about equal to *LF* and the outside diameters of the pinion and wheel may be drawn through *K* and *L* respectively. The root circles *MN* and *OP* may then be drawn in position allowing for the required decrease in center distance plus the allowance for running clearance and the profiles may be filled in, and the tooth thicknesses adjusted to give equal strengths to the two gears. The shape of the profiles below the base circles should be obtained by rolling one gear profile over the other and not by rolling a rack tooth over the gears as this latter method gives more undercut than is necessary for the gears to mesh without interference.

It will probably be found that some adjustment is necessary to the initial layout in order to give a satisfactory appearance to the finished gears. Should they appear not wide enough at the tips, the pressure angle should be decreased, and should there be too much undercutting, the pressure angle should be increased. If both of these disadvantages occur it will be necessary to reduce the overlap from 1¼ times the base pitch to not less than one base pitch.

It is preferable in the case just dealt with to cut the gears by means of rotary milling cutters or pinion-shaped generating cutters. The hob or rack-type cutter is apt to give too much undercut at the roots of the teeth, thus reducing the strength and in some cases removing some of the working portion of the profiles of the teeth. If the latter type of cutter is used, it should be well rounded off at the tips to reduce the amount of undercut. It is not usually possible to generate both the gears with the same hob or rack-type cutter (except in the case of small increases in center distance) owing to the fact that the cutter will not be of conjugate thickness with both the gears; the pinion will come to a point at the tips more quickly

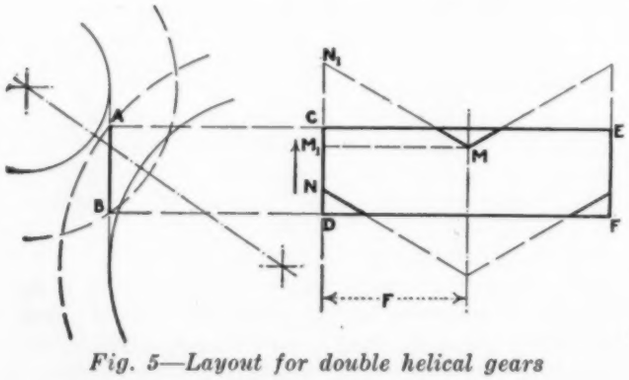


Fig. 5—Layout for double helical gears

than the wheel and consequently the pinion will require a cutter to give a tooth thickness greater than standard and the wheel will require a cutter to give a tooth thickness less than standard.

For helical or double helical gears it is not essential that the line of action shall be sufficiently long to cause overlap in the extended position since if the face width is greater than the axial pitch, the necessary continuity of action will be attained by the lateral overlapping of the teeth, thus rendering overlapping in the transverse plane unnecessary.

Fig. 5 shows two views of a pair of double helical gears in contact. All the contact must take place on the plane through *AB* parallel to the axes of the gears, and this area is represented by *CDEF*. The contact of double helical gears occurs along straight lines tangential to the base cylinders of the gears and inclined at the base cylinder spiral angle. Thus in the diagram the thick lines represent the lines of contact and the condition for continuous contact is that, if the teeth be traveling in the direction of the arrow, some portion of the tooth *N* must lie in the plane *CDEF* before the

Fig. 6—Tooth profiles in open and closed positions

tooth *M* has completely left this plane. This condition is satisfied if the vertical distance between *N* and *M*; that is, NM_1 is less than the width *CD* of the contact zone. Now this vertical distance NM_1 is equal to the base pitch NN_1 minus N_1M_1 (= *F* × tangent of base cylinder spiral angle) and therefore the condition is that *AB* is greater than the circular base pitch minus the semi-face width, multiplied by the tangent of the base cylinder spiral angle; that is, *F* must be greater than

$$\frac{\text{Base pitch} - AB}{\text{tan base cylinder spiral angle}}.$$

Of course this is the extreme case and it will usually be found necessary only when it is desired to keep the face width as small as possible. For general cases, continuous contact is insured by making the semi-face width greater than the axial base pitch.

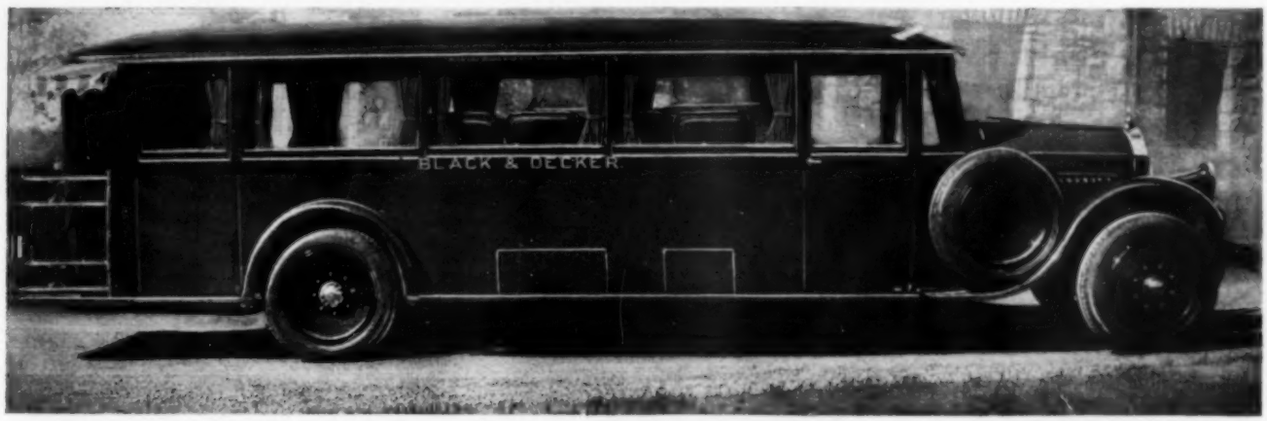
Sheet-Steel Tests Discussed

At a meeting of the subdivision on sheet steel of the Society of Automotive Engineers, held in Cleveland on Nov. 15, W. C. Peterson, chairman of the subdivision, stated that a recent investigation of the extent to which sheet steel is tested by users shows that tests are seldom made. Reliance is placed entirely on the use of proper forming dies and machines for working the sheet steel.

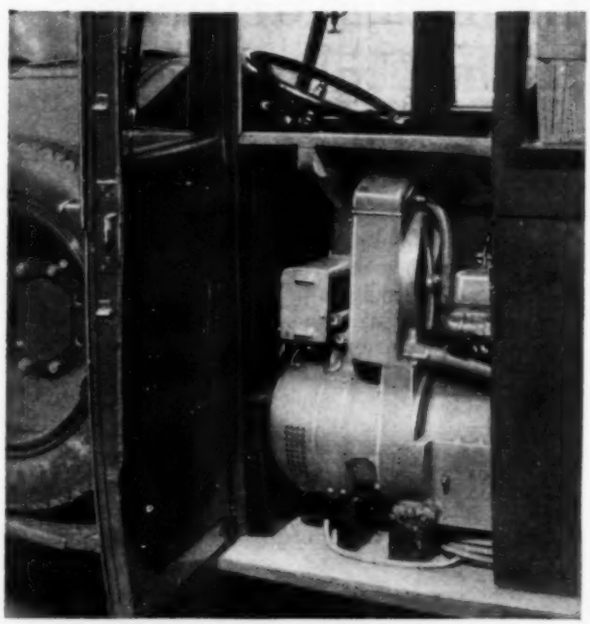
J. M. Darke stated that the sheet steel subcommittee of the American Society for Testing Materials had prepared specifications for cold-rolled strip which include chemical composition, but that this material is different from sheet metal as it is usually used when high strength in the product is wanted. He also said that the chemical composition is important especially with regard to carbon and that it is relatively easy to control the physical properties for each grade.

Representatives of the sheet steel manufacturers were of the opinion that dimensional standardization, would be of little use in manufacture because it is now a simple matter to meet customers' requirements.

The subdivision finally decided that before discontinuing work on this subject, a final questionnaire should be sent to the larger users of sheet steel to determine present conditions and requirements.

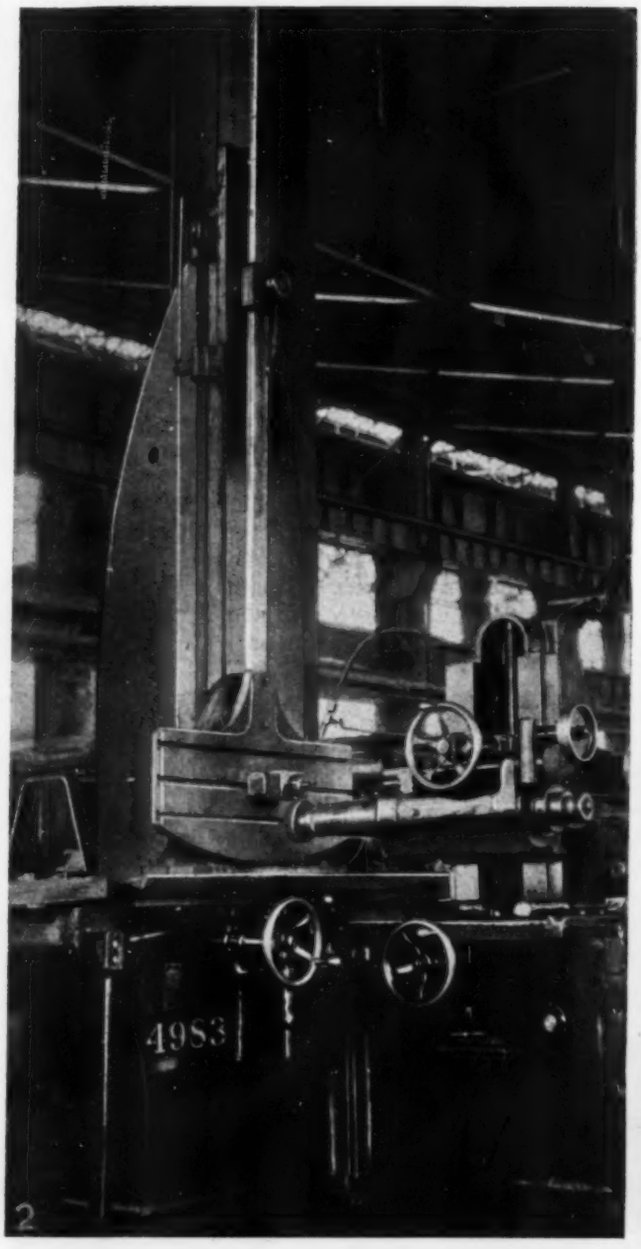


A Showroom on Wheels



Here is the way a Pierce-Arrow coach has been fitted up by Black & Decker, Towson, Maryland, to serve as a traveling demonstration room. The three men who make up the crew include a driver, an advertising expert and a demonstrator of the tools carried in and on the walnut buffet shown. A separate power plant supplies the necessary power and a big trunk at the rear of the coach contains advertising displays for the use of the advertising expert who puts them in the jobber's windows while his salesmen are in the coach listening to the demonstration.

1



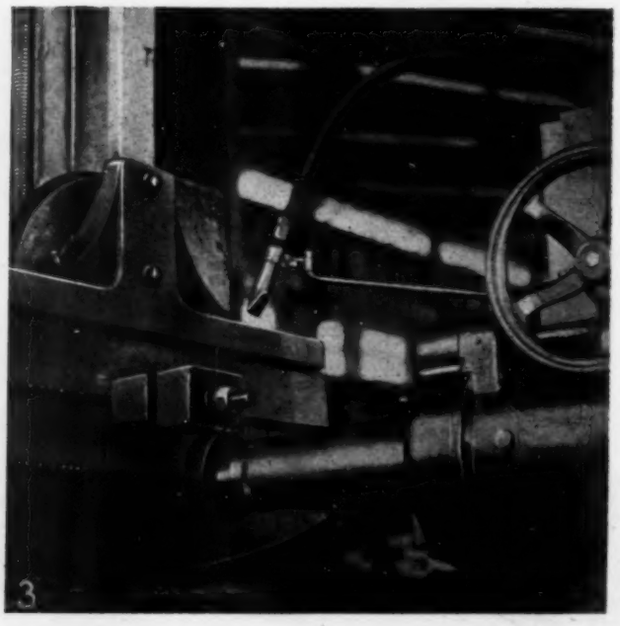
2

Grinding Methods in the Finley Shops

By James M. Plaskitt
Mechanical Engineer, Southern Railway

THE use of the grinding machine has found a prominent place in the railroad shop for the reconditioning and rebuilding of rolling stock and the upkeep of tools and equipment. The usefulness of this type of machine for a variety of work is herewith shown, the operations being examples of grinding methods as adopted by the Southern Railway at the Finley shops, Birmingham, Ala., where production has been benefited somewhat by the inclusion of modern grinding facilities.

Such parts as crosshead guides, exhaust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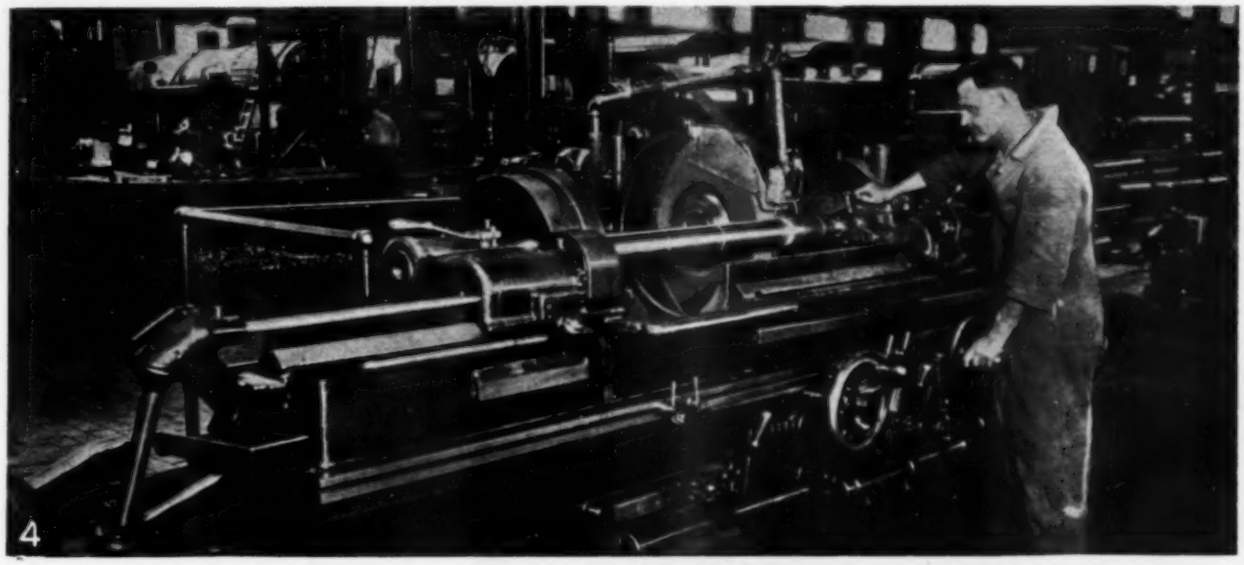

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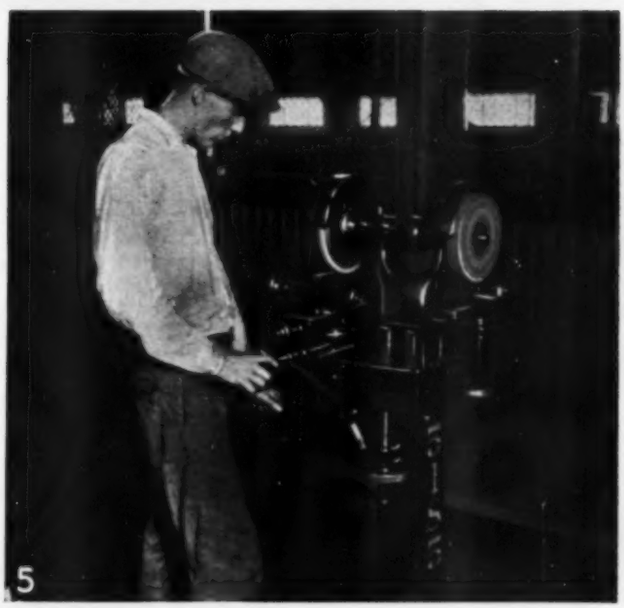
stands, flat steam-pipe joints, driving-box cellars, slide-valve faces, main-rod keys and blocks and miscellaneous flat surfaces that require finishing are now handled on the Diamond face grinding machine shown in Fig. 1. These parts were formerly machined on various types of machines as was best suited, but since being finished on the grinding machine it has been possible to increase the output. The illustration shows a crosshead guide bar in the process of grinding.



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Grinding Radial Work

For the internal grinding of valve-motion links and the external grinding of link blocks, as well as other repair parts to be finished on radial surfaces, there has been installed in the valve-motion department of the machine bay the Sunstrand radial grinding machine shown in Fig. 2. The work assigned to the machine was formerly ac-

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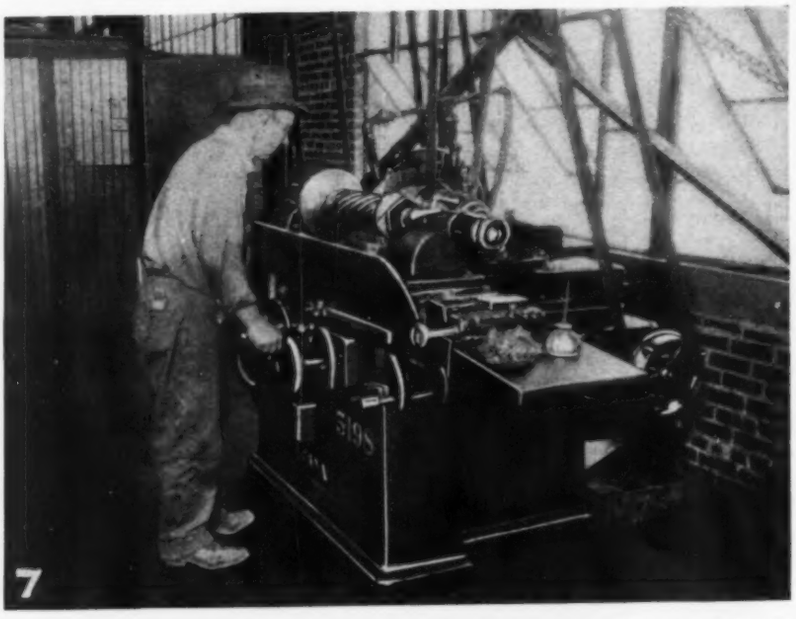
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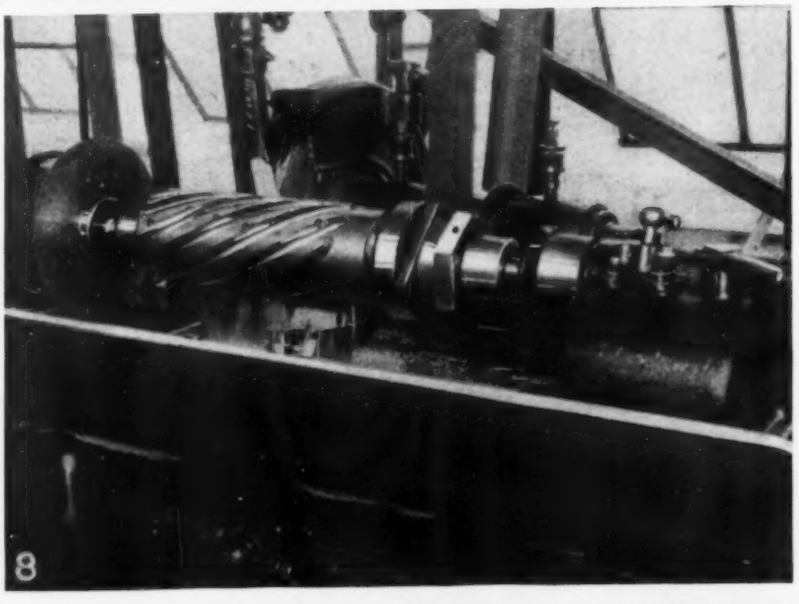
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complished on planers with special radius attachments, or by hand draw-filing methods. In Fig. 3 is shown a link block set up for grinding. In the machine bay there is also a swing frame grinder used for grinding side and main rods, valve-motion connecting levers or other flat surfaces. It has the portable feature that is desirable.

Cylindrical Grinding

On the Norton gap grinder, shown in Fig. 4, repair parts consisting of piston rods, either mounted or unmounted, valve stems, valve yokes, trailer cradle-pins, re-turned crank pins, various kinds of shafting and circular repair parts for heavy-duty machinery are ground. The work was formerly turned for finish.

In Fig. 5 is shown a Geometric tool grinder.

Pneumatic Portable Grinder

A number of pneumatic portable grinding machines, such as shown in Fig. 6, are used for various classes of erecting work. By the use of these tools such work as facing, filleting, filing and chipping have been combined into the one operation of grinding. Such machine tools as planers, shapers and pneumatic hammers and hand tools have been materially relieved and assigned to more urgent work. The portable grinders are used on erecting work, including the filleting of side and main rods after they have been milled, the filleting of driving boxes at the ends of the shoe and wedge ways, preparing surfaces for electric and thermit welds and the facing and filleting of pedestal jaws. It is also the present practice to finish or grind the back flue sheets on this type of grinder preparatory to the welding of the beaded flues.

Reamer and Cutter Grinder

In Fig. 7 is shown a Cincinnati No. 2 Universal grinding machine located in the toolroom. It is used for the reconditioning of milling cutters, reamers, and radial stay taps. In Fig. 8 is shown a close-up view of the set up.

Tool Grinding Machine

Another machine of interest in the toolroom is the Sellers universal tool grinder shown in Fig. 9. This machine is used extensively for miscellaneous work on flue cutters, drills, heavy-duty machine tools and taps.

Ideas from Practical Men

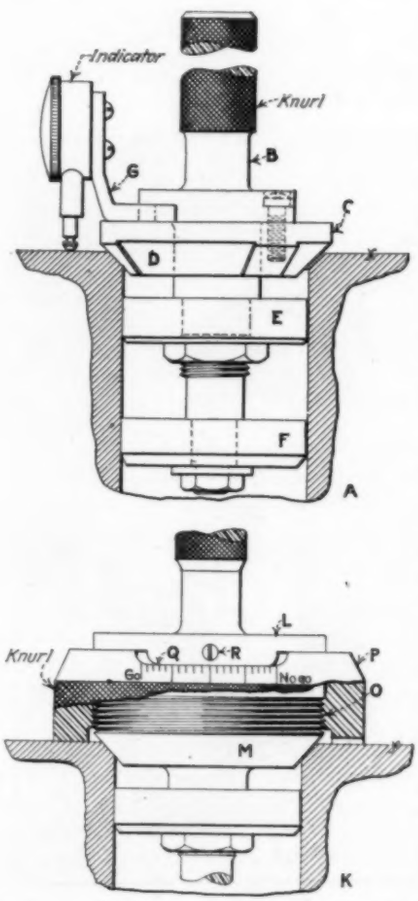
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Gages for Checking Valve Seats

BY FRANK WALDO

The illustration shows two gages used for checking the depth of valve seats in relation with the top surfaces and in line with the bores, both gages being used for similar classes of work. The difference in their construction offers a comparison of gage design, bringing out a few points that may be used on a variety of gages for other work.

At *A* is shown an indicator-type gage that comprises a shaft *B*, to which is fastened the gaging unit. The collar *C* is located against the flange of the shaft and held in place by filister-head screws. The collar is made angular to correspond with the surface of the valve seat, and is cut away in three places, as a *D*, to reduce the contact surface and possible error by the presence of chips or dirt. The plug rings *E* and *F*, fit in the bore, having 0.002 in. clearance, and are assembled on the shaft, being held in place by nuts. The collar and both plug rings are hardened and ground in position at assembly, to insure alignment. The indicator is attached to the collar by means of the bracket *G*. When the gage is located in the hole, it may be revolved so that a reading may be taken in various positions. This, however, is not necessary, if the bore has been made at a right angle with the face.



Construction of gages for valve seats

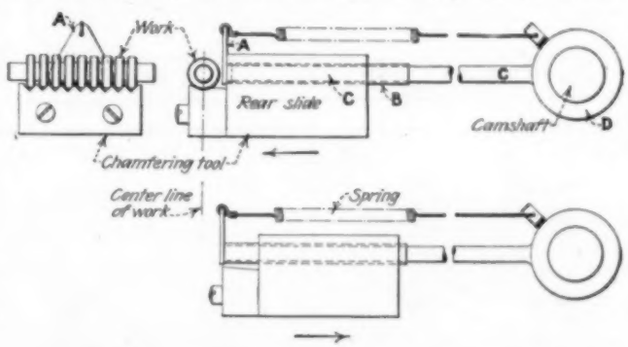
The gage shown at *K* varies somewhat in design and is a simple and accurate means of measuring small variations. The body *L* has an angular face, *M*, on its under side. The lower portion of the gage is made similar to the gage at *A*, having two plug rings mounted on the lower end. A threaded portion on the body at *O* holds the ring *P*, which is cut out at *Q* to allow a circular movement, limited by the pin *R*. The thread is 25 per in., and the graduations are marked to 0.001 in. The pitch of the thread, and the graduations may be made to suit various limits.

Work Ejector for an Automatic Screw Machine

BY H. J. BOLL

In making the part shown in the accompanying sketch, on an automatic screw machine, the forming tool was put on the front slide; the chamfering and cut-off tools on the rear slide. In order to accomplish the chamfering, the tool for this operation must pass under the work while the cutting off takes place. When cut off, the work drops on the chamfering tool and must be removed by the operator, thus making it a "one man" job.

In order to make the job fully automatic, an ejector was devised, which works as follows: The block on the rear slide that holds the chamfering tool is drilled



Ejector attached to rear slide of screw machine

and reamed for a sliding fit for the tube *B*. To the tube *B*, is welded, or brazed, the ejector plate *A*. The rod *C* is attached to the collar *D* which in turn slides over the camshaft. Rod *C* is a sliding fit in tube *B*.

In the upper view, the rear slide has come forward (left) and the chamfering tool has passed under the work. As soon as the cutting off has been completed,

IDEAS FROM PRACTICAL MEN

the rear slide starts back (right). Plate *A* follows the slide, being pulled back by the spring shown, until it comes in contact with the rod *C*. The rod then holds the ejector plate in one position while the chamfering tool passes completely under it, as shown in the lower view. In this way the work is pushed off the top of the chamfering tool by the ejector plate.

The spring and the clearance between the plate *A* and the rod *C*, are used to allow for variations in set-up and slide travel.

Difficult Work Made with Few Tools

BY CLIFFORD H. FRENCH

One of the unusual jobs that came to the Pioneer Instrument Co., Brooklyn, N. Y., some time ago, was the making of a small quantity of hinges to fit surfaces that were both curved and tapering; in other words a cone of large diameter and slight taper. The finished hinge is shown in Fig. 1 both in halves and assembled.

The blank and the very simple punch and die with which it was made, are shown in Fig. 2. The punch was made of the proper size to take out the piece *A* and by taking three bites in the long opening. The corners at each end of *A* were also cut with the same punch.

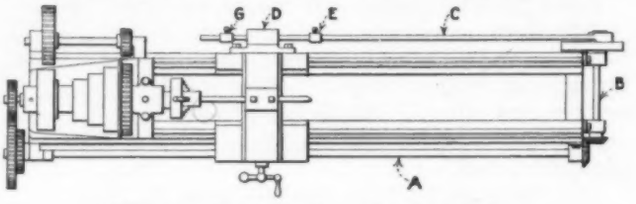
With the blank at *A*, Fig. 3, the next step was to bend it with the four ears up, as at *B*, this being done in the forming die in Fig. 4. With the blank in this shape it goes into a simple die that crimps the ears and then bends them over to form the eye for the hinge pin. The two halves are then separated by a slitting saw and the hinge is ready for assembly.

Lathe Fitted for Cutting Oil Grooves

BY H. L. WHEELER

The simple and inexpensive attachments shown in the illustration, were fitted to an old lathe that had outlived its usefulness as a production machine. With these attachments, figure-eight oil grooves can be rapidly cut in bushings up to 12 in. in length.

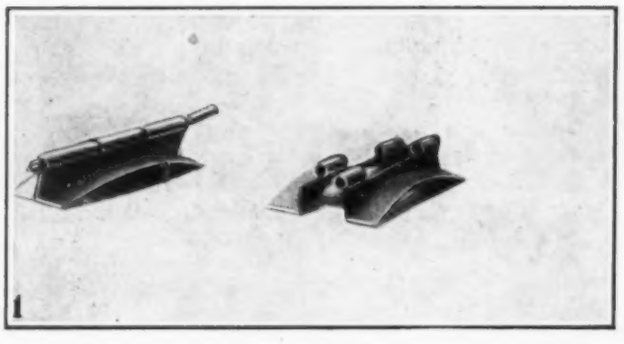
In fitting up the lathe, the shaft *A*, turned at one end and provided with a key to fit the change gears and fitted at the other end with a miter gear, was substituted for the lead screw. At a right angle to shaft *A*, the shaft *B* was mounted in plain bearings and attached to the tailstock end of the lathe bed. The shaft *B* was

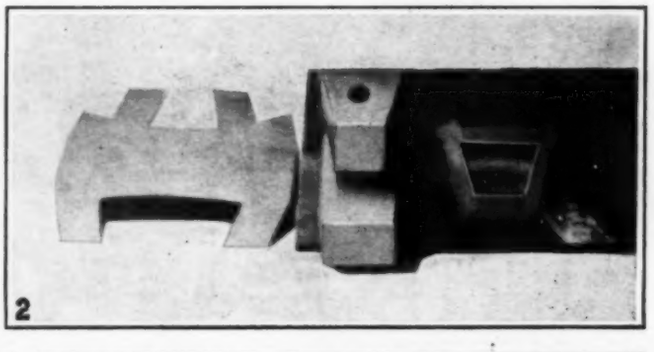


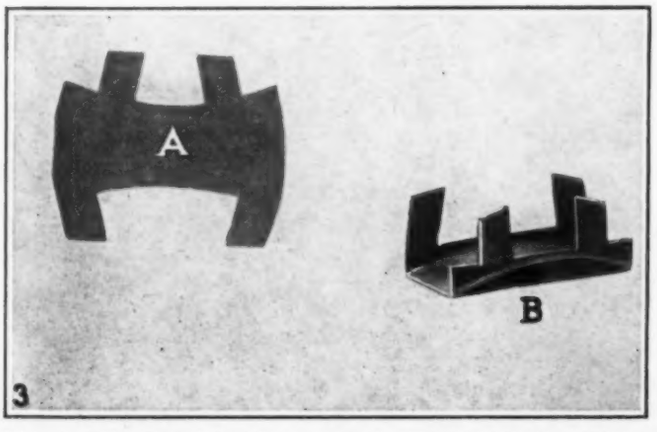
Oil-grooving attachment on a lathe

provided at one end with a miter gear, meshing into the miter gear on shaft *A*, while at the opposite end a slotted disk was fitted.

One end of the connecting rod *C* was attached to the pin of a block adjustably mounted in the slot of the disk, while the other end led through the swivel block *D*, attached to the back of the carriage. The connecting rod was provided with two collars, *E* and *G*, adjustable thereon, as shown in the illustration.







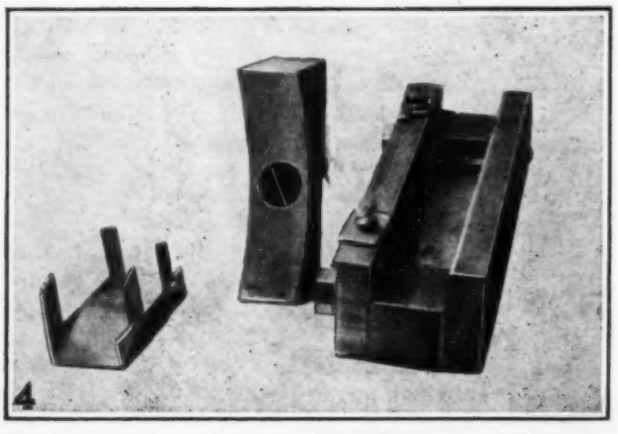


Fig. 1—The completed hinge. Fig. 2—The blank and die used in cutting it. Fig. 3—How the ears are formed. Fig. 4—Former for bending ears

IDEAS FROM PRACTICAL MEN

It will readily be seen that with the lathe in motion and both collars on the connecting rod set tightly against the swivel block, the carriage would have a reciprocating motion, the amplitude of which would be equal to twice the throw of the crankpin. Setting the collars away from the swivel block would not only reduce the amount of carriage travel, but would cause the carriage to dwell at each end of the stroke. Thus, by combinations of the change gears and various settings of the collars and the crankpin, many variations in the shapes of the oil grooves can be secured.

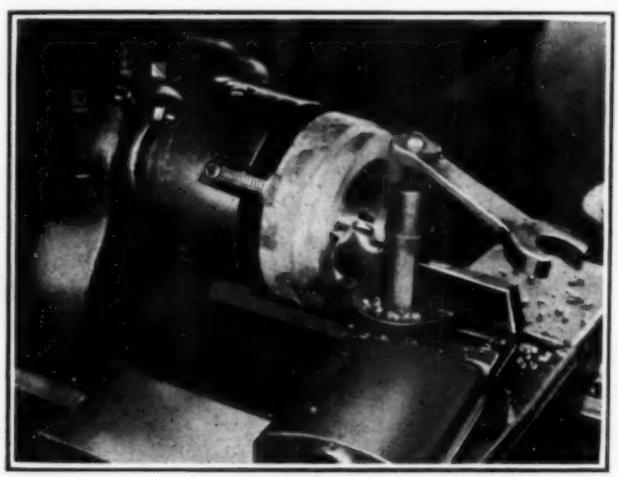
A toolblock of simple design was fitted to the cross-slide, so that a bar carrying a toolbit could be adjusted lengthwise of the lathe and locked in position.

A "Wabble" Chuck in the Toolroom

By Milton Wright

When making tools to blank heavy sheet metal, it is necessary to impart a shear to the cutting edges in order to relieve the press of a strain that might be beyond its capacity, though the blank may seem comparatively small. Though it is the punch that is usually given the shear when thinner stock is to be blanked, there are times when it is very desirable to give the shear to the die instead. In a shop where many round blanking dies are made, the chuck here shown is kept at hand to do the work.

There is nothing unusual about the chuck itself—it is an ordinary three-jawed, universal chuck of standard make—but the faceplate to which it is attached has



A "wabbling" chuck

been faced off at an angle of about 5 deg. with the axis, so that the chuck "wabbles" in a manner startling to the uninitiated beholder.

A die to be given shear, is set into the chuck and faced off as would be any ordinary piece of work, except that the tool cuts a heavy chip at one side of the perimeter and nothing at all at the diameter line. After one side has been finished to the satisfaction of the toolmaker the die is turned half-way round in the chuck and the process repeated on the opposite side of the center, making both sides alike.

Layout for Machining the Slot in an Open-End Wrench

By Robert U. Ruddell

The accompanying sketch illustrates a two-operation method of machining a clamp slot in an open-end wrench.

In Fig. 1 is shown the first operation, which is one of hand milling with power feed to remove as much stock as possible.

In Fig. 2 is illustrated the second or shaving operation, showing three positions of the work and tool progressively. In the view to the left, the tool is at

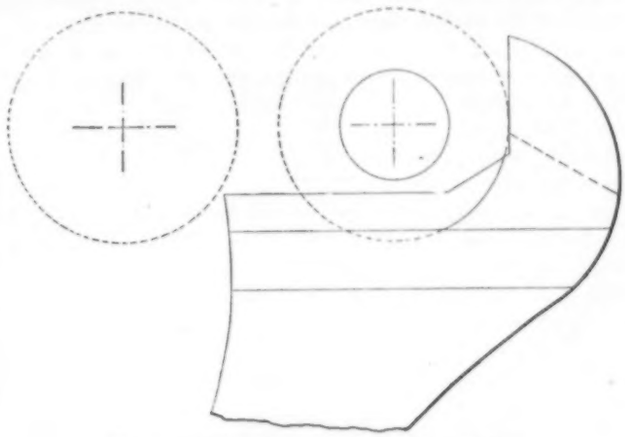


Fig. 1—The initial milling operation

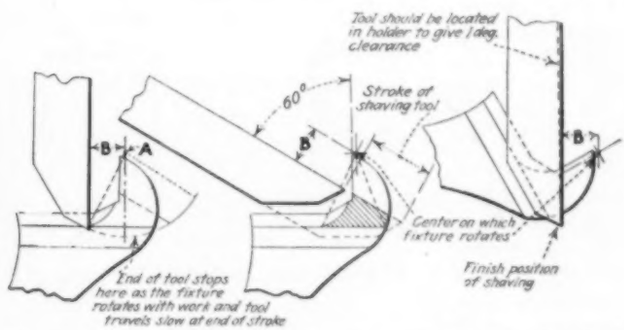

Tool should be located in holder to give 1 deg. clearance
60°
Stroke of shaving tool
B
A
B'
A'
B
Center on which fixture rotates
End of tool stops here as the fixture rotates with work and tool travels slow at end of stroke
Finish position of shaving

Fig. 2—Three positions of the work and the shaving tool

the beginning of the operation, at about the center in the center view, and at the finish of the cut in the view to the right. In the central view is also shown a cross-section of stock that is to be removed by the shaving operation.

The fixture for the milling operation may be of any suitable design mounted on the table of a milling machine that has power feed.

The holding means for the shaving fixture should secure the work at the same points and surfaces as in the milling fixture and should be designed to rotate around the center at *A*. This rotation should be by power feed.

It can be seen that the distance *B* is constant and the shorter this distance is made in the design of the fixture, the easier the feed mechanism will hold against the force of the shaving cut.

The shaving operation should be done in a press having sufficient capacity for the work in question.

IDEAS FROM PRACTICAL MEN

The Protection of Thermo-Couples in Electrically-Heated Salt Baths

BY L. E. CREASE

Suitable protecting sheaths for pyrometers gave practically no trouble until electrically-heated salt baths were brought into use in the heat-treating departments of our industrial plants.

The ordinary gas furnace, in which the work is heated directly by the flames, presents few difficulties as far as the pyrometer sheaths are concerned. Cast iron was soon found to be the most inexpensive material giving satisfactory service.

Gas or oil-heated barium-chloride baths, in general use throughout the country a few years ago, in which the thermo-couple must be submerged in order to give an exact indication of the temperature, were the cause of numerous experiments with materials ranging from silica to nickel and chromium alloys. Unfortunately, in spite of its excellent qualities as an impenetrable sheath, silica proved too fragile for any but laboratory use. Mild-carbon steel was finally adopted in the form of a tube, one end of which was made airtight by fusing it in order that the salt, when heated to 900 or 950 deg. C., would not force its way through to the couple. These tubes gave satisfactory results.

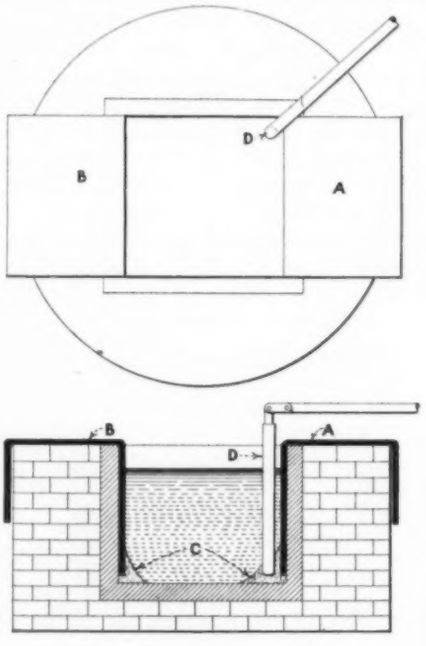


Fig. 1—Illustration of the cause of trouble

When electrically-heated barium-chloride baths were brought into existence, another phenomenon was encountered. The action of the electric current, combined with the corrosive properties of the fused salts, wore away the metal tube in from three to five days when running at 850 deg. C. The position of the pyrometer is shown in Fig. 1 in relation to the electrodes. This illustration explains, at least partially, the origin of the trouble which seems to reside in the contact established between electrode, *A*, and the pyrometer sheath, *D*, by the slag, *C*, which falls to the bottom of the crucible and is drawn into the corners. The current thus passes between electrode *B* and the sheath, instead of passing from one electrode to the other.

No practical remedy being available, protecting tubes of various compositions were again tested, and the nickel-chromium alloy triumphed in all but one point. These tubes lost practically no weight, but all became porous after three or four days of continuous running at 850 deg. C., due to the presence of slag, which is almost impossible to eliminate in pouring this alloy.

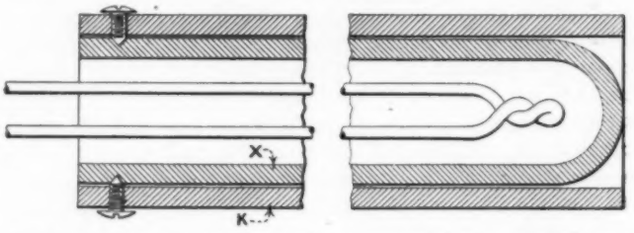


Fig. 2—Cross-section to show successful construction

The slag in this case seems to have an affinity for the salts and soon joins them, leaving a series of small holes in the tube through which the salt penetrates.

A non-porous sheath is required to insure the thermo-couple against any conductor which would short-circuit the two elements, and non-corrosive metal is required to protect this sheath.

The results of the previous tests led to the solving of the problem, which was accomplished by combining the well known properties of steel and nickel-chromium alloys.

In Fig. 2 is shown the end of a pyrometer mounted with a double sheath, *X* being the mild-steel sheath and *K* the alloy sheath.

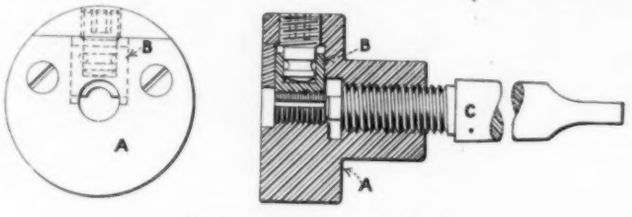
A Simple Stud Driver

BY CHESTER H. FRANKLIN

Driving studs is such a common operation that we might naturally expect to find stud drivers and stud driving methods standardized, but there still remain a variety of practices.

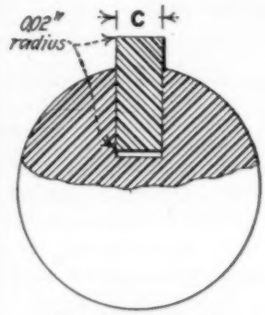
The stud driver illustrated, used by The Chandler Motor Car Co., Cleveland, Ohio, has the advantage of being simple and efficient. It consists of the body *A* with a thread in one side of the opening and a sliding, threaded jaw *B* in the other, this being controlled by the special headless setscrew shown.

The body screws on the shank *C* with a thread of much coarser lead than that of the stud. The end of the shank has a point of smaller diameter, that bears against the end of the stud being driven. This combination of a loose jaw and a coarse thread on the shank allows the stud to release easily and permits it to be driven rapidly. The headless setscrew is flush with the surface of the body and avoids danger to the operator. A pin in the movable jaw fits the groove in the setscrew so that both move together at all times.

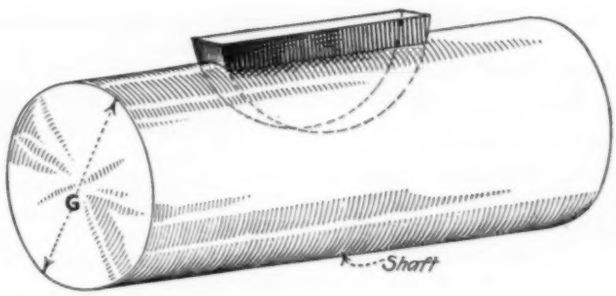


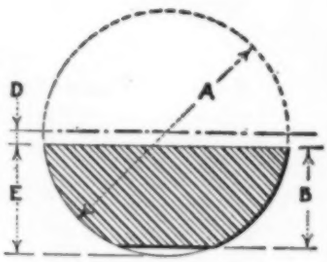
Driver for engine studs

Standard Key Limits—Woodruff System



Section Through Center of Key





Key No.	Diam. A	Height B	Thickness C	D	E	Width of Keyseat	Width of Keyway
0	0.250 0.260	0.112 0.117	0.0625 0.0635	0.008	0.112 0.117	0.0615 0.0625	0.0635 0.0645
00	0.3125 0.3225	0.135 0.140	0.0937 0.0947	1/64 +0.005	0.135 0.140	0.0927 0.0937	0.0947 0.0957
000	0.375 0.385	0.167 0.172	0.125 0.126	1/64 +0.005	0.167 0.172	0.124 0.125	0.126 0.127
1	0.500 0.510	0.187 0.193	0.0625 0.0635	1/64 +0.005	0.198 0.203	0.0615 0.0625	0.0635 0.0645
2	0.500 0.510	0.187 0.193	0.0937 0.0947	1/64 +0.005	0.198 0.203	0.0927 0.0937	0.0947 0.0957
3	0.500 0.510	0.187 0.193	0.125 0.126	1/64 +0.005	0.198 0.203	0.124 0.125	0.126 0.127
4	0.625 0.635	0.234 0.240	0.0937 0.0947	1/64 +0.005	0.245 0.250	0.0927 0.0937	0.0947 0.0957
5	0.625 0.635	0.234 0.240	0.125 0.126	1/64 +0.005	0.245 0.250	0.124 0.125	0.126 0.127
6	0.625 0.635	0.234 0.240	0.1562 0.1572	1/64 +0.005	0.245 0.250	0.1552 0.1562	0.1572 0.1582
61	0.625 0.635	0.234 0.240	0.1875 0.1885	1/64 +0.005	0.245 0.250	0.1865 0.1875	0.1885 0.1895
7	0.750 0.760	0.296 0.302	0.125 0.126	1/64 +0.005	0.308 0.313	0.124 0.125	0.126 0.127
8	0.750 0.760	0.296 0.302	0.1562 0.1572	1/64 +0.005	0.308 0.313	0.1552 0.1562	0.1572 0.1582
9	0.750 0.760	0.296 0.302	0.1875 0.1885	1/64 +0.005	0.308 0.313	0.1865 0.1875	0.1885 0.1895
91	0.750 0.760	0.296 0.302	0.250 0.251	1/64 +0.005	0.308 0.313	0.249 0.250	0.251 0.252
10	0.875 0.885	0.359 0.365	0.1562 0.1572	1/64 +0.005	0.370 0.375	0.1552 0.1562	0.1572 0.1582
11	0.875 0.885	0.359 0.365	0.1875 0.1885	1/64 +0.005	0.370 0.375	0.1865 0.1875	0.1885 0.1895
12	0.875 0.885	0.359 0.365	0.2187 0.2197	1/64 +0.005	0.370 0.375	0.2177 0.2187	0.2197 0.2207
A	0.875 0.885	0.359 0.365	0.250 0.251	1/64 +0.005	0.370 0.375	0.249 0.250	0.251 0.252
121	0.875 0.885	0.292 0.295	0.250 0.251	1/64 +0.005	0.370 0.375	0.249 0.250	0.251 0.252
13	1.000 1.010	0.421 0.427	0.1875 0.1885	1/64 +0.005	0.433 0.438	0.1865 0.1875	0.1885 0.1895
14	1.000 1.010	0.421 0.427	0.2187 0.2197	1/64 +0.005	0.433 0.438	0.2177 0.2187	0.2197 0.2207
15	1.000 1.010	0.421 0.427	0.250 0.251	1/64 +0.005	0.433 0.438	0.249 0.250	0.251 0.252
B	1.000 1.010	0.421 0.427	0.3125 0.3135	1/64 +0.005	0.433 0.438	0.3115 0.3125	0.3135 0.3145
152	1.000 1.010	0.421 0.427	0.375 0.376	1/64 +0.005	0.433 0.438	0.374 0.375	0.376 0.377
141	1.000 1.010	0.359 0.365	0.250 0.251	1/64 +0.005	0.370 0.375	0.249 0.250	0.251 0.252
131	1.000 1.010	0.344 0.350	0.3125 0.3135	1/64 +0.005	0.433 0.438	0.3115 0.3125	0.3135 0.3145
16	1.125 1.135	0.468 0.474	0.1875 0.1885	1/64 +0.005	0.480 0.485	0.1865 0.1875	0.1885 0.1895
17	1.125 1.135	0.468 0.474	0.2187 0.2197	1/64 +0.005	0.480 0.485	0.2177 0.2187	0.2197 0.2207
18	1.125 1.135	0.468 0.474	0.250 0.251	1/64 +0.005	0.480 0.485	0.249 0.250	0.251 0.252
C	1.125 1.135	0.468 0.474	0.3125 0.3135	1/64 +0.005	0.480 0.485	0.3115 0.3125	0.3135 0.3145
161	1.125 1.135	0.468 0.474	0.3125 0.3135	1/64 +0.005	0.480 0.485	0.3115 0.3125	0.3135 0.3145
19	1.250 1.260	0.531 0.537	0.1875 0.1885	1/64 +0.005	0.542 0.547	0.1865 0.1875	0.1885 0.1895
20	1.250 1.260	0.531 0.537	0.2187 0.2197	1/64 +0.005	0.542 0.547	0.2177 0.2187	0.2197 0.2207
21	1.250 1.260	0.531 0.537	0.250 0.251	1/64 +0.005	0.542 0.547	0.249 0.250	0.251 0.252
D	1.250 1.260	0.531 0.537	0.3125 0.3135	1/64 +0.005	0.542 0.547	0.3115 0.3125	0.3135 0.3145
E	1.250 1.260	0.531 0.537	0.375 0.376	1/64 +0.005	0.542 0.547	0.374 0.375	0.376 0.377
22	1.375 1.385	0.578 0.584	0.250 0.251	1/64 +0.005	0.589 0.594	0.249 0.250	0.251 0.252
23	1.375 1.385	0.578 0.584	0.3125 0.3135	1/64 +0.005	0.589 0.594	0.3115 0.3125	0.3135 0.3145
F	1.375 1.385	0.578 0.584	0.375 0.376	1/64 +0.005	0.589 0.594	0.374 0.375	0.376 0.377
24	1.500 1.510	0.625 0.631	0.250 0.251	1/64 +0.005	0.635 0.640	0.249 0.250	0.251 0.252
25	1.500 1.510	0.625 0.631	0.3125 0.3135	1/64 +0.005	0.635 0.640	0.3115 0.3125	0.3135 0.3145
G	1.500 1.510	0.625 0.631	0.375 0.376	1/64 +0.005	0.635 0.640	0.374 0.375	0.376 0.377

Sizes of Keys for Shafts of Various Diameters

G-Shaft Sizes	Width of Keys	Key Numbers
1/4 to 7/16 in.	1/16	3, 5, 7
1/2 to 7/8 in.	3/32	61, 9, 11, 13, 16, 19
1 to 1 1/4 in.	1/8	91, A, 121, 15, 141, 18, 21, 22, 24
1 1/8 to 1 3/4 in.	5/32	B, 131, C, 161, D, 23, 25
1 1/2 to 1 3/4 in.	3/16	152, E, F, G

For the data given we are indebted to the Whitney Manufacturing Co.

Punch here to suit your binder

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Economical Operation of a Dust-Exhaust System

Q. We have set up an exhaust system for the purpose of ridding our factory of the dust created in our grinding department. The system consists of branches from each grinder leading to a trunk line that is connected to a dust collector on the roof. We desire to run the system economically, and want to know the effect on horsepower input and efficiency of operation by manipulating the various inlets. Should we close off those that are not in use at a given time or leave them all open? The system is installed according to the best practice. The blower is sufficiently large to allow for doubling the units at a later date.

A. We suggest, in the first place, that you secure from the blower manufacturer the characteristic chart for this piece of equipment. This chart will show the horsepower requirements and the air delivered for various inlet and outlet areas at a given speed of rotation and air velocity. With these data you can check your installation.

You will also be able to see the effect on the horsepower input by decreasing the inlet areas which usually is to decrease the power required.

While the velocity of air entering the open inlets will remain nearly the same as before certain ones were shut off, the velocity in the trunk line will naturally decrease, since the area does not decrease. The result is a lowering of the dust-carrying capacity of the stream of air in the trunk and an increasing tendency of the dust to begin dropping out and building up in the horizontal sections.

Once the trunk line has begun to build up, it is very difficult to clear it out again and we suggest, with these points in view and the manufacturer's chart, that you run an experiment to give you the economical performance curve you want.

The Correct Side of the Arc for the Work in Arc-Welding

Q. We operate a d.c. arc-welding set on repair work, and a question has been brought up as to whether polarity between the electrode and the work makes any difference; that is, whether the electrode or the work should be on the positive side of the arc. Please advise us on this point.

A. More heat will be liberated from the positive side of a d.c. arc than from the negative side. The work is generally much greater in mass than the electrode, and it will carry away a greater quantity of heat from the weld. As a result, it is customary to make the work the positive side so the temperature of the work at the weld will be brought to the fusing point at the same time that fused metal drops from the electrode.

In case very thin metal is being welded, it may be advisable to reverse the polarity to prevent burning through. In fact, for welding manganese steel, bronze and similar metals it is often necessary to reverse the polarity and make the work the negative side of the arc.

Centering a Conveyor Belt

Q. We have a 60-ft. belt conveyor on which we are having trouble to keep the belt from running off to one side. Please let us know what we can do by way of remedy. The belt will be ruined unless we can find a way to keep it centered.

A. The belt can be made to center, unless the conveyor frame is badly out of line or the end pulleys are not square with each other. These two conditions should be checked and, if necessary, corrected first.

Then loosen the frames that carry the troughing rolls and insert a wedge strip on the side toward the driving pulley so the whole roll assemblies will be tipped forward at a small angle with the conveyor frame. Care should be taken in keeping the assembly in line with the driving and driven pulleys. This has the same effect as making cone pulleys or rollers of the slanting rolls that will act to keep the belt midway of its support and will try to feed it back to center as it starts to crawl sideways.

Compressed Air for a Heat-Treating Furnace

Q. We have purchased a small heat-treating furnace and are ready to connect it up, except for the blower. We have high-pressure air available, and before deciding on a blower we desire to know if this compressed air can be used to advantage. We shall appreciate your advice.

A. There are a number of companies manufacturing devices that can be used in this connection. The principle of operation is to admit a stream of the high-pressure air through a nozzle arranged to induce an additional flow from the atmosphere through orifices, so the use of high-pressure air will be small in comparison to the total required for combustion.

As in all uses of compressed air, there are points that must be watched to maintain economical operation. The size of the orifice must be correct for the pressure at which it is to be used. If an attempt is made to get more air by drilling it out, there will be a waste of compressed air. If there is moisture in the line, as there usually is in high-pressure systems, means should be provided for its removal.

It is also a good idea, in the event there are fluctuations of pressure in the supply line, to install a tank of fair size close to the point of use to act as an accumulator and steady the delivery.

Technical Abstracts

Work Benches

Bench height is all important according to John Herbert's theory in order to get maximum working convenience for each bench or vise hand. We should fit the man to the bench just as we fit him with a suit of clothes. This is practically impossible so a compromise is struck whereby the top of the work bench is made 34 in. from the floor level, bringing the top of the jaws of the average vise to elbow height of the average sized man. Next to bench height comes the choice of bench width and 24 in. wide is considered proper for a narrow bench, while 29 in. represents the generally accepted full or standard width. Wooden benches are no longer considered practical either from the standpoint of cost or service. The preferred bench leg is made of pressed steel which provides lightness with strength.

One of the first principles to keep in mind before choosing a plank is the direction in which work will ordinarily be slid or moved over the bench—the grain of the wood should lie in the direction of travel. Maple is the ideal wood for bench planking, but it is sometimes hard to get in the thicknesses desired and a compromise is usually effected by having the front plank of solid maple 3 in. thick by 12 in. wide, running length-wise with the bench. Zinc or galvanized-iron sheet covering is not entirely satisfactory. Assembly benches can be profitably designed to suit the operations done upon them. This is particularly true for light assembly where the operator is seated in a fixed position. —*Industry Illustrated*, Oct., 1925, p. 12.

Centerless Grinding

A review of British practices in centerless grinding is given by W. Ogilvie in a paper before the British Institution of Production Engineers. If a machine of the ordinary type is considered, it is found that the actual time taken for the removal of metal by the most suitable grinding wheel is extremely short. It is only a small proportion of the actual time cycle per piece. Centerless grinding machines have been developed with the object of making the actual grinding time a much greater proportion of the total; the great advantage being that grinding is continuous. If cylindrical work is one diameter, such as rollers, piston pins, etc., and of the type which can be passed through the machine from one side to the other, the grinding point is practically 100 per cent continuous. In cylindrical work having one or more diameters to be ground, when the centerless grinder is used, the actual operation of placing the work in position and removing it is three or four times faster than in the center grinding machine and no driving arrangement is necessary.—*The Automobile Engineer*, (England), Oct., 1925, p. 348.

Effective Reports

"Why do reports fail?" asks J. Eigelberner, consulting engineer. Sometimes it is because they are not read, having been poorly written, dry or uninteresting. Othertimes it is because the ideas or plans prepared are impractical. Sometimes they fail to carry conviction, principally because the facts advanced are backed only by personal opinion and not by sufficient proof. Again, the writer may be so positive of the soundness of his position that he forgets that the reader is just as sure that the present way is right, consequently there is no meeting of the minds. Reports must be accurate as to facts and sound as to recommendations; they must be prepared from the standpoint of the reader and must include only those matters directly pertinent to the subject. They must be carefully divided into parts logically arranged and long enough to properly cover the subject but not so long as to become tedious. A report is not a monument to the individual writing it, but is a means to an end.—*Industrial Management*, Oct., 1925, p. 214.

Tool Problems

Anker L. Christensen, of the Worthington Pump and Machinery Corporation, says that, generally speaking, the output of a machine tool is in proportion to the capacity of a very few ounces of steel at the cutting tip. Sometimes the mere changing of a cutting tool or the method of hardening or the kind of steel used may speed up the production on an expensive machine to a point where the saving is many times the cost of the change. Before adopting a new tool it should be subjected to thorough shop tests. A careful record should be made of each and every tool that is on trial in the factory. A standard form should be worked out for the data obtained.

The problem of disposing of tools that have become obsolete is closely connected with that of keeping the tools up to date. Old and obsolete tools accumulate with surprising rapidity. The three sources of obsolete tools are: First, the development of better tools; second, changing methods of machining and third, manufacture of the product discontinued. Whether a tool should be salvaged for further service requires a careful study of conditions. It is easy to spend $2.00 in service work to save $1.00. It is poor economy for a factory to wear out a lot of used carbon-steel drills when production could be doubled by the use of high-speed tools, but on the other hand a loose policy of scrapping is sure to send good and serviceable tools to the scrap box. However, it is better policy to err on the side of scrapping tools when obsolete than to attempt to spend money on salvaging processes. No tool should be made in the tool room without a sketch or drawing. A vast amount of trouble arises from the practice of making tools to samples. The cost of making up drawings is considerable but the resulting benefits of having the tools made to standard will more than compensate for the cost of the drawings.—*Management and Administration*, Oct., 1925, p. 201.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Machine Tool Standardization —By the User

AN ANNOUNCEMENT that may come as something of a shock to machine tool builders is to the effect that the Society of Automotive Engineers has established a Production Division of its standards committee. The portentious part of the announcement is that this division will concern itself with efforts to standardize work- and tool-holding elements of machine tools, to eliminate the needless variations in certain dimensions of machine tools and to standardize methods of operation of similar machines.

There is no disputing the fact that for a long time automotive manufacturers have felt the need for a limitation to the varieties existing in parts of machine tools, table heights, arrangement of drive, and so on. Their success in standardization of their own product has encouraged them to undertake the new work.

As a matter of fact it must be admitted that many S.A.E. standards, sound and useful as they are, have failed to "take." The standard gear-shift, for instance, is not used by at least two of the biggest and most prosperous car makers.

At the same time it will hardly be wise for the makers of machine tools to ignore the efforts of users to standardize certain features of the tools. They should have done something themselves in this direction long ago, but as they never have it will be politic to offer to co-operate with representatives of their largest market.

Thirty-Five Millions for Research

ACCORDING to the Chamber of Commerce of the United States American industry is spending thirty-five million dollars annually on co-operative laboratory research. The bulletin issued on the subject further estimates the savings that can be credited to such research to something like a half billion dollars. This looks like a very gratifying return on the investment, comparable perhaps to that possible from intelligent standardization work.

The range of association expenditures for research is from a few hundred to several hundred thousand dollars. The majority of associations seem to be spending upwards of twenty thousand. A little arithmetic will show that the load on each member company is absurdly small in proportion to the benefits attainable.

Unfortunately the value of co-operative research is not universally recognized. The National Machine Tool Builders' Association and the American Gear Manufacturers' Association, for instance, are conspicuous by their absence from the list of those active in research work. It was like pulling teeth to collect the very small sum needed to finance the construction of the latest Lewis gear testing machine now installed at Massachusetts Institute of Technology. Just why is hard to say because the information possible from the projected tests by this machine would be of great value to all the members of both associations.

Sound conservatism is a valuable characteristic, in individuals or in companies, but it can be carried so far that those blessed with less of it and more initiative walk away with the business.

A Tribute to a Great Engineer

AT THE RECENT meeting of the Academy of Political Science in New York one could not help but be impressed by the fact that every speaker at the morning session paid tribute to the Secretary of Commerce in some part of his remarks. The subject under discusssion was the trade association and its place in the modern business fabric. That place is now far more secure than ever before and largely as a result of the unceasing warfare on the traditional conception of the trade association that has been carried on by Mr. Hoover ever since he joined the Cabinet.

Had it not been for his efforts Congress and certain sections of the administration would still consider the trade association as an evil organization conceived in the interest of heightened prices and undeserved profits.

Mr. Hoover has long ranked as a great engineer but now he is perhaps better known as a master economist and administrator. The praise of the speakers at the Academy has been well earned.

A Worthy Cause

A REMINDER has just come in to say that Golden Rule Sunday will be observed on December 6th. On that day prosperous and happy Americans are urged to eat a little less than usual and think of the thousands of orphans cared for by the Near East Relief, children who never have quite enough. Their plight, remember, is through no fault of their own. They are the unhappy victims of the World War. Compare their sad lot with that of your own children, or grandchildren, and do something to help bring them to the point where they can support themselves. They owe their lives to Americans and there is no one else to care for them. The Near East Relief has representatives in your city.

Shop Equipment News

Société Genevoise Jig-Boring Machine, No. 6

Through the R. Y. Ferner Co., Investment Building, Washington, D. C., the Société Genevoise d'Instruments de Physique, Geneva, Switzerland, is placing on the market the fifth of a series of high-precision locating and jig-boring machines. The No. 6 machine, illustrated in Fig. 1, is similar in construction to the Nos. 4 and 5 previously described on page 385, Vol. 59 of the *American Machinist*, which are smaller in size and have been on the market for some time.

In addition to its use for drilling holes in jigs and fixtures, the machine can be used to advantage in making tool-steel dies for die casting and in laying out profiling dies, punches, cams and special gages, as well as for doing much of the cutting involved in their manufacture. It will also serve as a measuring machine, since, by reason of the accurate perpendicular relation of its spindle to the table, it can be used for checking dimensions between points on different levels without necessitating the use of special devices to transfer from one plane to another. It can be used for developing work since models and experimental machines can be built with it which, it is claimed, will have higher precision than those constructed by the jig and fixture method.

The machine has a horizontal bed with ways along which the work carriage is moved by means of an accurate lead screw. A second lead screw on the cross-slide is used to move the tool holder. The cross-slide is mounted between two uprights. The errors in the lead screws are automatically compensated by means of curved templets attached to the carriages. These templets are previously cut in accordance with the measured errors of the lead screw as mounted in place. A steel finger follows the contour of the templets as the carriage moves, and, through a lever system, the vernier index of the micrometer head is shifted back and forth slightly to correct the errors in the screws. The accuracy of the No. 6 machine corresponds with that of the Nos. 4 and 5 for which the guaranteed maximum errors between axes of bored holes for full capacity of the machine are between 0.0006 in. and 0.0008 in., respectively, while the accuracy of the lead screws themselves is 0.0002 in. and 0.0004 in., respectively.

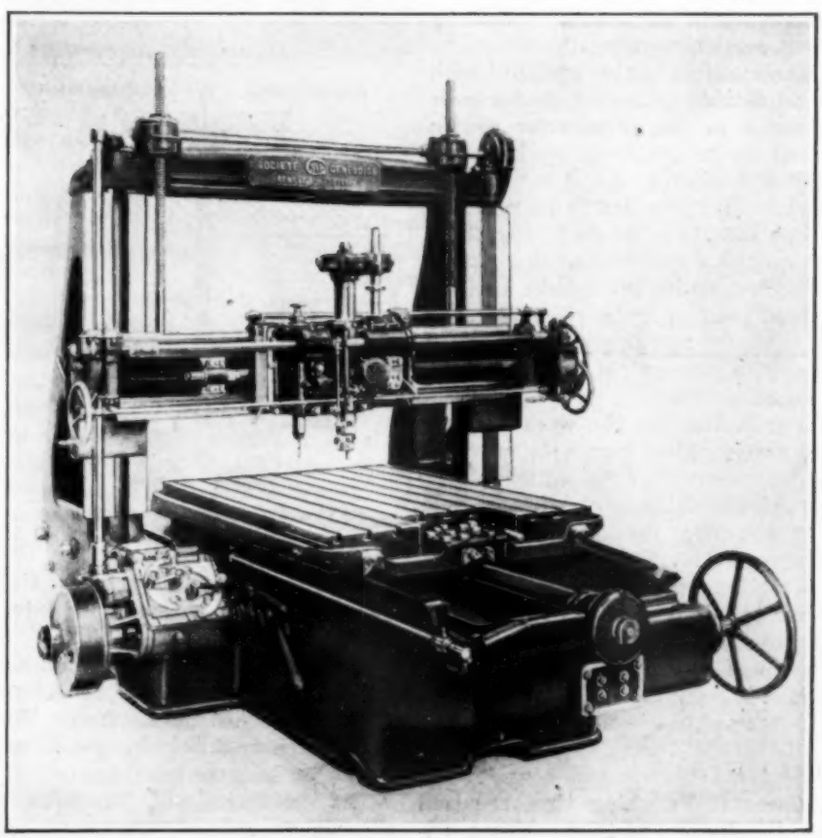


Fig. 1—Société Genevoise Jig-Boring Machine, No. 6

The vertical uprights on which the cross-slide is mounted are set on calipered ways which are closely perpendicular to the plane of the work table. The two vertical screws are mounted in the same relative position and geared together to reduce the chances for error. This construction makes for uniformity in wear of the screws since the two screws will tend to wear equally.

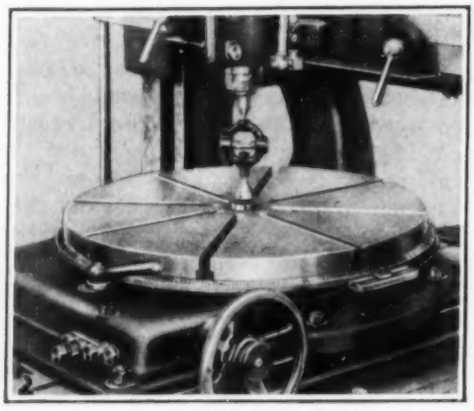
There are two drilling and boring spindles on the tool carriage. The larger one, for the main drilling and boring operations, has a Morse taper No. 3 and is capable of drilling holes from $\frac{3}{4}$ to $1\frac{3}{4}$ in. in diameter or of boring holes up to 6 in. in diameter. The smaller, high-speed spindle, previously described on page 225, Vol. 60, of the *American Machinist*, has a No. 2 Morse taper and is adapted for drilling holes from $\frac{1}{16}$ to $\frac{3}{4}$ in. in diameter. The vertical movement of tools in the former spindle is 10 in. and in the latter is 4 in. Automatic feed of the tools in the two spindles is provided at 0.003, 0.005, 0.008 and 0.012 in. per turn.

Both spindles are driven direct through a shaft and gears and are controlled by means of a clutch

SHOP EQUIPMENT NEWS

coupling that can be operated from either side of the machine. Nine speeds of rotation are provided. The speed of the larger spindle ranges from 40 to 200 r.p.m. while that of the high-speed spindle ranges from 200 to 1,000 revolutions per minute.

The two lead screws have a pitch of five threads per inch and micrometer heads graduated to 0.0005 in. per division, on which, with the aid of verniers, the readings can be made to 0.00005 in. The micrometer heads are protected from injury by a shield in which an opening is provided at the point of reading of the index.



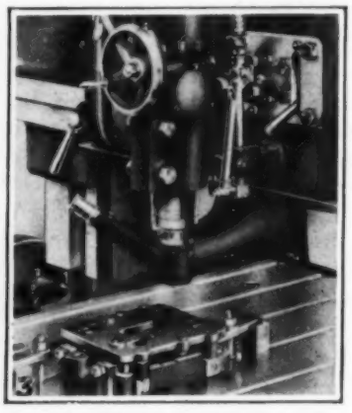


Fig. 2—The circular divided table. Fig 3—The "broken-tube" microscope

To facilitate handling the machine, a motor drive is provided which can be used for moving the table over the greater part of its course. For this drive a semi-automatic device is provided. This device consists of a spindle connecting the micrometer screw of the table to the gear box containing the main drive of the machine by means of a clutch and gear. The drive is controlled through a lever by which the table is automatically stopped when the lever is not held in position by the operator. A 2½-hp., constant-speed motor is used so that the mechanical movement will not irregularly heat up the lead screw or parts adjacent to the table. A 9-speed, gear-reduction box is mounted on the left side of the machine and is driven by a single pulley 13½ in. in diameter, which is connected by a short belt to the motor placed on the floor almost below it.

In addition to its use for laying out work in rectangular co-ordinates, by means of the 24-in. circular divided table illustrated in Fig. 2 the machine can be used for laying out points in polar co-ordinates. Centers, also shown in Fig. 2, are provided with a rotating level set between them to enable placing the center of the table beneath the axis of the spindle accurately. The rotation of the circular table is measured by means of a wormscrew with a vernier index by which readings can be made to one second of an arc, with an accuracy of setting of the order of 15 to 20 seconds of an arc. A special angular table can be used for mounting the circular table in order to drill oblique holes radially about a central axis.

The machine is also equipped with an adjustable indicating device to be mounted in the spindle for use in lining up or centering work on the table. A microscope with "broken" tube is also provided to be mounted in the spindle as shown in Fig. 3. It is equipped with cross-hairs put in coincidence with the spindle axis for use in reading upon points already laid out, for checking purposes or for measuring up an old job to test its present accuracy.

For laying out the work a semi-automatic center punch is provided to be mounted in the spindle, with its point in coincidence with the axis of the spindle. By rotating a knurled ring on this punch device against the action of a helical spring, the point is raised by a cam action until the compression is sufficient to give the punch mark desired, when the punch is released. No further check measurements are necessary for the drilling and boring of holes. It is said that this method considerably reduces the working time required by the button method. Three adjustable boring-tool holders are provided by which holes truly round within 0.0005 in. can be produced.

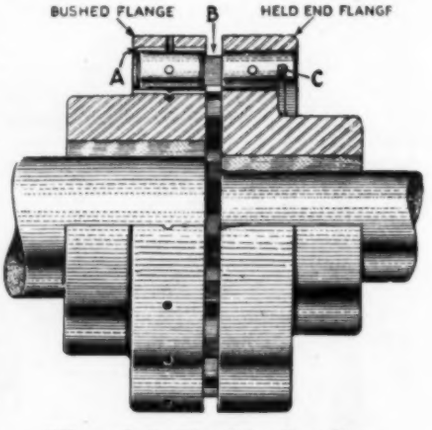
The work table of the No. 6 machine is 40x59 in. Its longitudinal travel is 51 in., while the transverse travel of the tool on the cross-slide is 40 in. The vertical travel of the cross-slide is 30 in., with a maximum distance of the tool above the table of 33½ in. The free passage between the uprights is 55 inches.

The length of the machine is 10 ft. and 6 in., its width is 8 ft. and 4 in., and its height is 10 ft. and 4 in. The total length required when the carriage is in its extreme position is 12 ft. and 2 in. The weight of the machine is 10,000 pounds.

"Francke" Flexible Couplings, Improved

Smith & Serrell, 20 Washington Place, Newark, N. J., have brought out an improved line of "Francke" flexible couplings. Below is a sectional drawing to show the construction of the couplings.

The fundamental design of the former models is retained in the present line and several improvements have been added, including room for more endwise movement, greater power and bore capacities, and steel flanges for small and intermediate sizes.



"Francke" Flexible Coupling, Improved

In the larger sizes graphited bronze bushings shown at *A* are removably locked in one flange. The steel pin units *B*, held by ring *C*, can slide ½ in. in these bushings.

The bearings will handle misalignments out of center, in an angular direction and endwise.

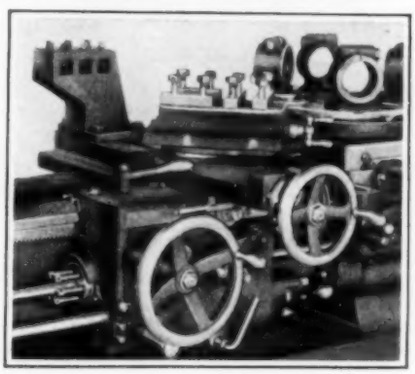
SHOP EQUIPMENT NEWS

Acme Turret-Lathe Compound Slide

The compound slide illustrated has been developed by the Acme Machine Tool Co., Cincinnati, Ohio. The cross-slide on the side carriage has been made longer so that a forming block can be mounted on the rear of the slide for back-facing and forming the angles of beveled gears.

The compound slide is to turn the faces of bevel gears and clutches or of any work where it is necessary to turn angles of a considerable degree. The slide has a swivel motion in relation to the cross-slide, so that it can be set at any desired angle and locked to the cross-slide.

The feed of the slide can be either



Acme Turret-Lathe Compound Slide

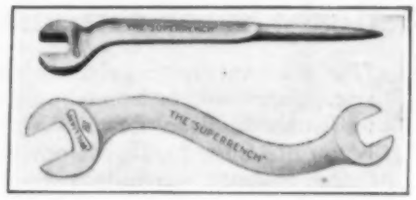
by power or by hand. It receives its power feed from the apron gears in much the same way as does the cross slide. On the front of the saddle and immediately under the cross-slide is a lever which operates a pull-pin arrangement. This lever is used for selecting the power feed for either the compound swivel slide or for the standard cross-slide. Moving the lever in one direction operates the power feed into the compound slide, while reversing the direction of the lever cuts out the power feed to the swivel slide and engages the power feed to the cross-slide.

Williams' Chrome-Molybdenum Wrenches

A line of wrenches, known as the "Superrench," made from heat-treated chrome-molybdenum steel, is being manufactured by J. H. Williams & Co., Buffalo, N. Y., to supplement their drop-forged wrenches made of carbon steel.

Chrome-molybdenum steel was selected because its use makes possible a considerable refinement in design with decrease in weight. The wrenches are made with narrow pointed jaws to give efficient service in cramped quarters. It is claimed that they will strip the thread of any standard nut or break the bolt without spreading the jaws.

The "Superrench" is made in four styles: the general service "S," engineers' construction and structural patterns. The general service "S" and the structural patterns are illustrated. All styles are furnished in nickel finish. The heads of the engineers' and the general service patterns are buffed bright.



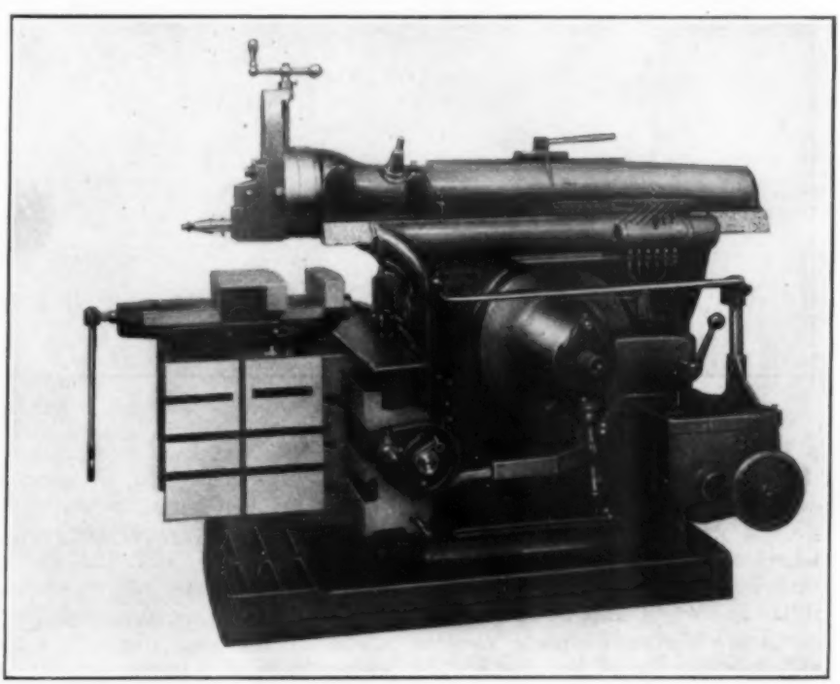
Williams' Chrome-Molybdenum Wrenches

Gould & Eberhardt "Invincible" Shaper 24-Inch

Gould & Eberhardt, Newark, N. J., announce the addition to their line of Invincible shapers previously described on page 901, Vol. 60 of the *American Machinist*, of a 24-in. size. The accompanying illustration is a photograph of the 32-in. size which is similar in construction.

The 24-in. shaper incorporates the same general design as the 32-in. machine, including V-ways for the ram, a double-train gear drive, a twin disk-plate type of clutch, a control brake, a raised bull gear to reduce strains on the main lever, a wide machine front, a centralized gravity lubricating system and a tool-head-slide lock. The weight of the machine is 5,600 lb. With the 24-in. shaper, the aim of the company has been to furnish a machine with a long stroke which can be used on lighter classes of work requiring high speed without sacrificing ample strength for heavy hogging cuts.

The arrangement of the starting levers and controls has been designed to simplify operation, so that small and complex jobs can be accurately shaped. The machine can be used on a wide range of small quantity production work to advantage.



Gould & Eberhardt "Invincible" Shaper, 24-Inch

SHOP EQUIPMENT NEWS

Besly Semi-Automatic Grinding Machine

The semi-automatic grinding machine, illustrated, is being built by the Charles H. Besly Co., 119 North Clinton St., Chicago, Ill. It consists of the company's standard No. 6 16-in. ring-wheel grinding machine equipped with a special rotary-type feeding disk. It is intended for use in simultaneously grinding two ends of conduit boxes in sizes ranging from ½ to 1 in. Just enough stock is removed to result in a clean surface. Work on the part of the operator is limited to placing the parts in the fixtures as the feed wheel revolves and carries them down between the grinding wheels. The parts will drop off at the bottom when the wheels are cleared.

The fixture is driven by a ¼-hp., 1,800-r.p.m., a.c. motor through reduction spur gearing, belt friction pulley and worm gearing to the feed wheel shaft. This shaft is mounted in a box-pattern frame attached to a T-slotted pad in the front side of the machine base. The worm gear and the shaft are hardened and are ground and run in oil. The feed wheel shaft is equipped with split removable bearings and a take-up collar and wheel collar. The moving parts are designed with a view to safeguarding them from dust.

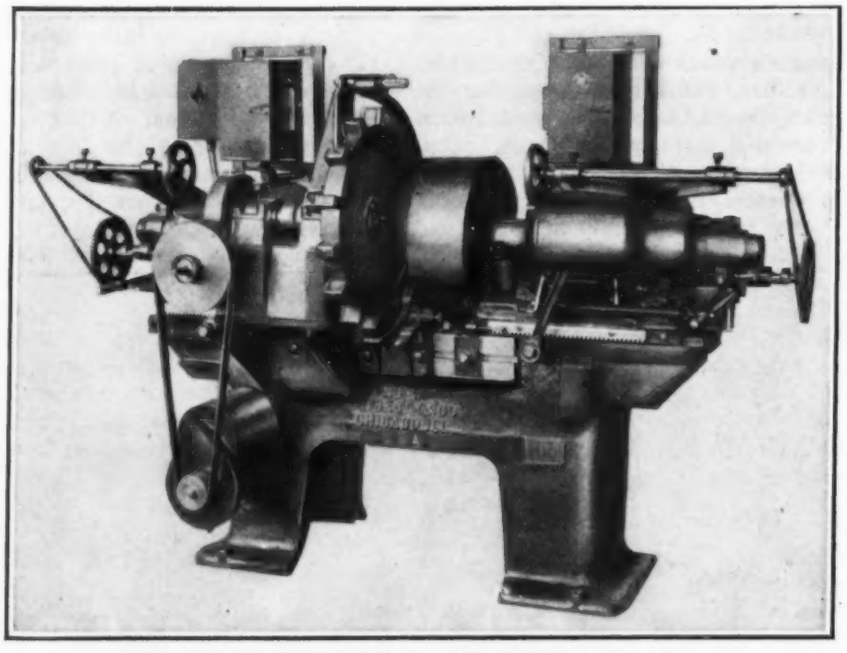


Fig. 1—Besly Semi-Automatic Grinding Machine

The feed wheels are secured to the wheel collar on the end of the feed wheel shaft by means of three cap screws, two wheels being required for each size conduit box. These wheels are made from gray-iron castings machined all over and equipped with hardened-steel chucking blocks rigidly attached to their outer periphery. A circular spring pressure bar is mounted between the grinding wheels to hold the work in place while the grinding is being done. These bars are lined with removable hardened-steel forms that can be replaced as they wear out.

In Fig. 1 the machine is shown as a complete unit, while in Fig. 2 a close-up view is given to illustrate the working of the fixture.

The design of the machine is essentially the same as that which was previously described on page 208, Vol. 61 of the *American Machinist*. The bed is 72 in. long and is designed especially for dry grinding. The top of the bed casting has two V-ways machined on them to receive the bed plates on which the special motor-driven heads are mounted. A T-slotted pad is provided on the front for the accommodation of various types of fixtures, while on the rear there is a machined strip that is used mainly for attaching a wheel-truing device.

The two motor-driven heads, one mounted on each end of the bed casting, are of 5 hp. each. The stators and rotors are standard type and are equipped with special end castings, the whole being fully inclosed. These two units are attached to the bed plates which are adjustable along the bed of the machine. The adjustment of each is controlled by rack and pinion movement. Three anchor bolts are provided to rigidly clamp them to the machine bed. The right-hand head is equipped with an aligning feature with adjustment in four directions. A special stop is also provided for resetting this head after dressing the wheels.

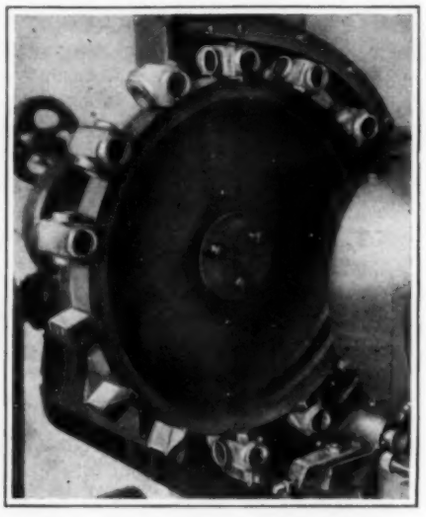


Fig. 2—A close-up view of the work-carrying fixture

The spindles are 2 in. in diameter by 34 5/16 in. long. They run in phosphor bronze ring-oiled bearings, which are 7¾x12½ in., each being equipped with two oil rings and a large oil reservoir, which insures ample lubrication.

End thrust is taken on self-oiling, hardened steel thrust collars, and each spindle is provided with means for taking up end play. The bearings are 2 in. inside diameter and 3 in. outside diameter, and slide endwise in the motor casting a distance of ¾ in. The outer end bearings have rack teeth which mesh into pinions controlling the endwise movement of the spindle.

The reverse thrust of the spindle is taken on ball thrust bearings fitted into the outer end of the rack-bearing bushing. The spindle nose is tapered

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and the wheel collars are secured to it with keys and a recessed nut. The spindles are each held in position with pull springs through levers and pinions.

Micrometer adjustment for each spindle is controlled by a micrometer screw fitted into a rack bushing at each end of the machine, and operated from the front of the machine by a handwheel shaft and sprockets. This feature makes it possible for the operator to make adjustment without leaving his position.

The grinding wheels are ring type measuring 16x4x8 in., and are held in the company's pressed-steel ring wheel chucks which have a setting-out adjustment to cover wheel wear. An exhaust hood is also provided.

The wheel dressing attachment is mounted at the rear of the machine bed, and is designed to swing between the grinding wheels. On thin work it is necessary to move one head back for the entrance of this attachment. The dresser has an endwise movement controlled by a screw and a balanced crank handle. The dresser cutters are made of the Huntington type mounted on a special arbor and are locked in position. This arbor runs on a hardened grease-lubricated spindle and two bronze bushings.

Allen & Billmyre Compressor, GA4

A four-stage compressor, directly connected to a 40-hp. motor is being manufactured by the Allen & Billmyre Co., Inc., 730 Grand Central Palace, New York. This compressor is one of a line of various sizes and capacities built by the company for similar purposes.

The machines are of the horizontal, multi-stage centrifugal type, the rotor being similar in principle to that of a turbine. They are applicable especially to conditions requiring a fairly constant pressure in the compressing or exhausting of air and gases, such as the aeration or agitation of water in ice manufacturing plants, gas circulating and pressure boosting, pneumatic tube and conveying systems.

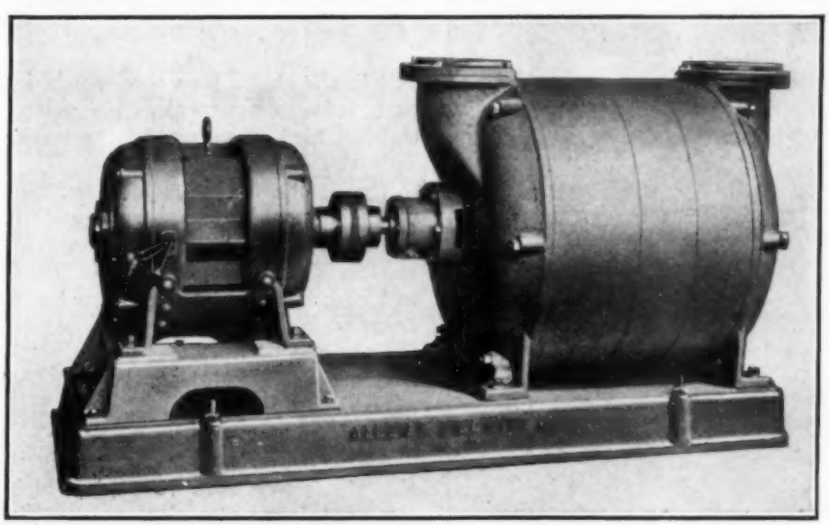
Multi-stage rotors, used on the equipment are mounted on a shaft which turns in SKF self-aligning ball and thrust bearings. The shaft is connected to the motor or steam turbine by means of a flexible coupling. Oil throwers are mounted outside of each of the two bearings. Both the compressor and the power unit or pulley-drive mounting are fastened to a heavy cast-iron base.

The impellers are one-piece aluminum-alloy castings keyed to the shaft and locked with a nut. Each machine is constructed of cast-iron sections bolted together, each section housing an impeller wheel. The machines are accurately balanced to reduce the chances of vibration.

The motors supplied for the drive may be for either a.c. or d.c. The d.c. motors are designed to rotate at 3,450 r.p.m. and the a.c. motors at 3,600 r.p.m. Fifty- or sixty-cycle 2- or 3-phase a.c. motors can be supplied as required to drive the compressors.

The smaller models are designed with self-contained driving motors and the equipment can be furnished for portable service if desired.

Capacities of air pressure range from 4 oz. to 10 lb. or vacua up to 12-in. mercury column. The sizes at present range from ¼ to 100 hp. but special sizes and capacities can be constructed to meet special needs.



Allen & Billmyre Compressor, GA4

"Chapman" Swing-Frame Grinder

The Transmission Ball Bearing Co., Inc., 1050 Military Rd., Buffalo, N. Y., is manufacturing the "Chapman" swing-frame grinder, illustrated, for heavy-duty service. The ball-bearing motor and the grinding wheel are direct-connected and mounted beneath an all-steel frame. The frame is designed to be suspended from a hoist, as shown.

The motor end of the grinding-wheel shaft is mounted in ball bearings in "Chapman" dumb-bell pillow blocks and it terminates in a flexible coupling which is connected to the shaft of the motor which is cooled by air circulation.

"Chapman" Swing-Frame Grinder

Air to cool the motor is drawn by a fan through the cylindrical strainer which may be seen to the left of the machine and it is exhausted below the motor. The grinding wheel is protected by a wheel guard that has an easily removable face to facilitate quick change of the wheels.

Handles are set in the wheel-guard housing for convenience in using the machine. Two bolts are used to hold the pillow blocks to the frame and the motor is rigidly fastened with four bolts.

SHOP EQUIPMENT NEWS

Peerless Universal-Type High-Speed Metal Sawing Machine 9x9-Inch

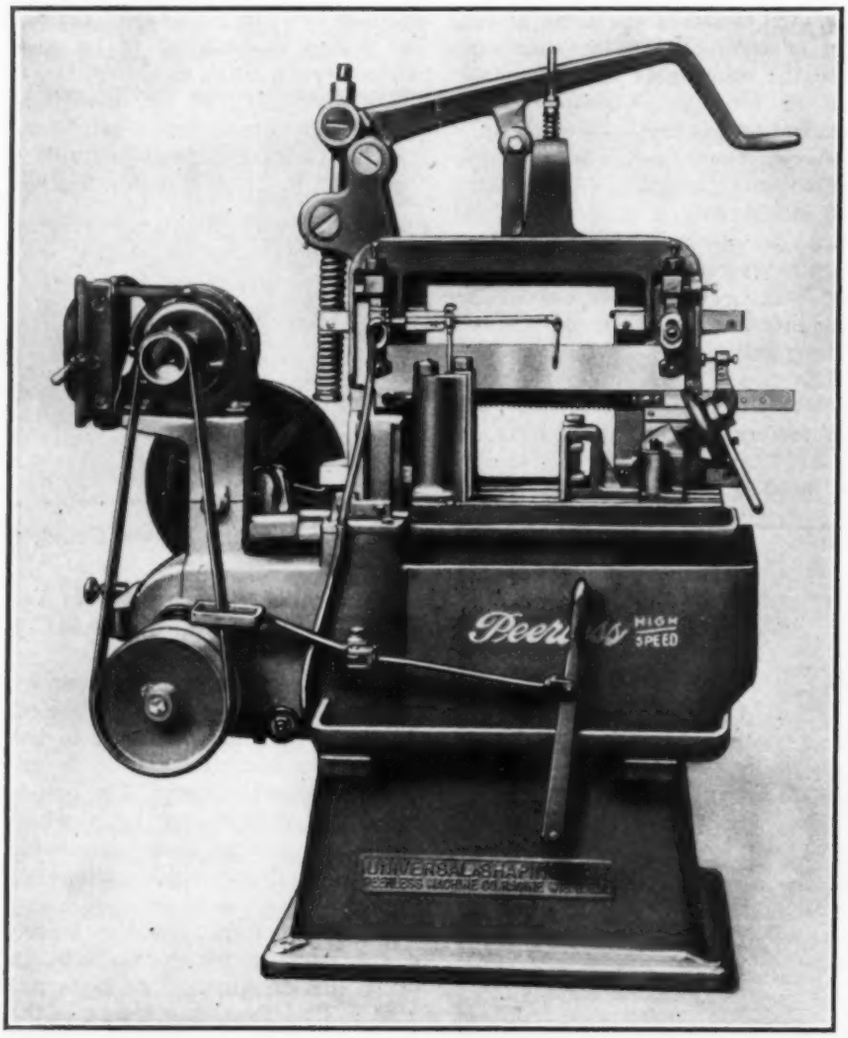
An addition to its line of universal-type, high-speed sawing machines has been made by the Peerless Machine Co., 1615 Racine St., Racine, Wis. The 9x9-in. machine supplements the 6x6-in. and 13x13-in. sizes previously described, respectively on page 386, Vol. 56 and on page 69, Vol. 59 of the *American Machinist*.

The 9x9-in. sawing machine illustrated incorporates the same principles of design as the other two sizes, including the full-square saw-blade frame, the quickly-adjustable spring-controlled feed pressure with a worm and ratchet type of feed, a blade-backing plate, a swivel vise, a three-speed gear box, a lift of the saw frame on the non-cutting stroke, the automatic stop and lift of the saw frame to starting position at the completion of the cut, as well as height and depth gages.

The machine is designed for drive from a 1½-hp., 1,700- or 1,800-r.p.m. electric motor. The motor is belt-connected to a shaft with a pinion engaging in a gear wheel by which the saw is reciprocated.

The capacity of the machine at a 45-deg. angle is 6 in. The blade length may range from 14 to 17 in. The length of the stroke is 6 in. while the three speeds of stroke are 125, 85 and 50 per minute. The speed of the 2½x10-in. driving pulley is 590 r.p.m.

The height of the machine from floor to vise is 33 in., while the floor space required is 26x52 in. The weight of the saw including the motor is 1,495 pounds.



Peerless Universal-Type High-Speed Metal Sawing Machine, 9x9-Inch

"American" Electric Ring Heater

The electric ring heaters, illustrated, are being manufactured by the American Hoist & Derrick Co., St. Paul, Minn. They are intended for use in uniformly heating locomotive tires, ratchet rings, gear rings and for similar work.

The heating is accomplished by building up an electromagnetic circuit in the closed iron core which, in turn, induces a current of low potential but high amperage in the work. This causes the latter to heat.

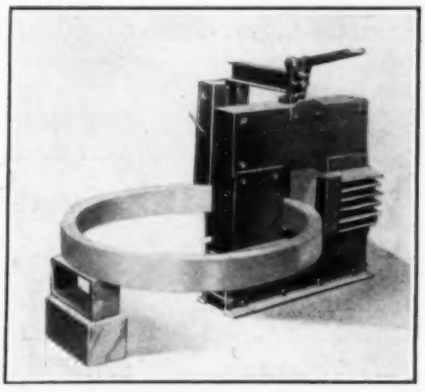


Fig. 1—"American" Electric Ring Heater

Fig. 2—The portable arrangement

The frame of the heater is built up of channel shapes. On the style shown in Fig. 1, the movable core at the top is arranged so it can be lifted and slid, back and forth, on a track from which it is suspended. After the piece to be heated is put in position around the stationary core, the movable core is pulled forward and lowered to complete the circuit.

There are several windings about the stationary core through which the energizing electrical current is passed.

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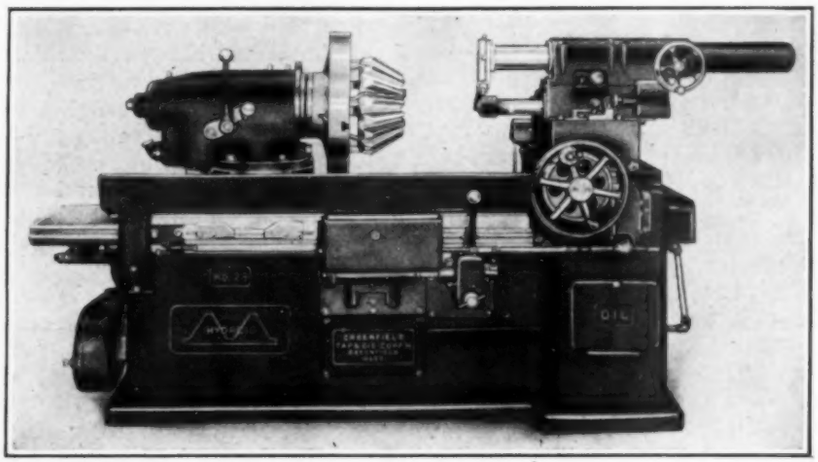
Greenfield Heavy-Duty, "Hydroil" Internal Grinder, No. 28

The Greenfield Tap and Die Corporation, Greenfield, Mass., has brought out an addition to its line of "Hydroil" internal grinding machines, previously described on page 192, Vol. 56, of the *American Machinist*. This machine is to be known as the No. 28 model, and is being built in two sizes for a 28-in. and 36-in. swing.



Greenfield Heavy-Duty "Hydroil" Internal Grinder, No. 28

The illustration is a front view of the machine which is particularly adapted for big-bore grinding. Straight, taper or face grinding can be done and work can be faced at the same setting as that for the internal grinding. The machine is built low to facilitate loading and unloading of heavy work.

The wheel-head slide has no longitudinal movement, but a cross movement on a heavy bridge is provided with one flat and one V-way. The design is said to insure alignment and freedom from vibration.

The workspindle is designed to carry heavy loads and is provided with a threaded nose 8 in. in diameter. Equipment regularly furnished with the machine includes a threaded ring that screws on the nose of the spindle to which face plates, chucks or fixtures can be attached.

The work table is reciprocated hydraulically by oil under pressure, from a cylinder and piston. The speed of the table movement is regulated by a valve at the front of the machine within easy access of the operator.

The feed screw rotates in ball thrust bearings and runs in a bath of oil. The handwheel for operating the feed screw is 14 in. in diameter and works in connection with a positive stop. The wheel-slide is also furnished with power feed taken from the table-reversing dogs.

The wheel-truing device, operated by a handwheel, is mounted on top of the wheelhead housing and is of rigid construction. Means for holding the truing diamond or dressing tool are provided at the end of the ram. This device is constructed for quick truing and surfacing of the wheel. Adjusting for the truing element is provided so that wear of the wheel can be taken up or wheels of different diameters used.

The machine is equipped with water guards to protect the bearings and slides and to protect the operator from spray of the coolant while the machine is in operation.

Wheelspindles of different sizes can be used to suit the work to be done. Holes 16 in. in diameter and 15 in. deep can be ground. When arranged to swing work 36 in. in diameter the height from the floor is 48 in. The floor space required is 11½x5½ ft. and the net weight is 8,800 pounds.

The changes that have been made over the model previously described are considerable. A motor drive has been provided at the left-hand end of the machine. The grinding head has been redesigned to provide the heavier construction necessary for the larger capacity. The hand wheels are all larger in diameter to furnish easier control and the traversing mechanism has been somewhat changed.

De Laval Worm Reduction Drive

A line of worm reduction gears has been developed by the De Laval Steam Turbine Co., Trenton, N. J., for service when a vertical shaft drive is desired. Fig. 1 shows a view of the unit with its vertical drive shaft and Fig. 2 is an illustration of the reduction gear with the cover removed.

The vertical unit is designed to replace bevel gears and vertical belts and can be used to advantage to drive vertical agitators, autoclaves, mixers and chaser pan mills. The lower bearing of the driven shaft and the worm bearings are supported in the gear casing. The upper bearing of the driven shaft is supported in the cover of the unit.

A small reciprocating oil pump is incorporated in the casing cover to provide oil for the upper wheel bearing. The plunger of this pump projects downward against the cam which can be seen on the vertical shaft in Fig. 2, outside of the thrust plate of this bearing. The thrust plate carries two oil grooves. By means of ball check valves oil is drawn in through a suction pipe projecting from the under surface of the cover down into the oil which is carried in the casing in a suffi-

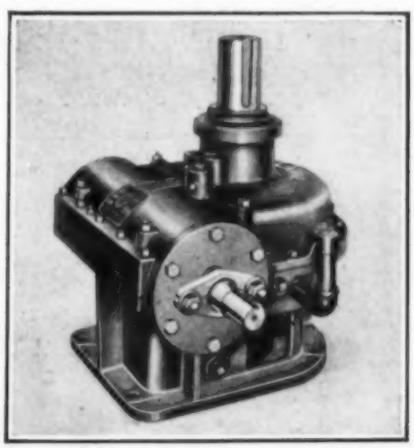


Fig. 1—De Laval Worm Reduction Unit

SHOP EQUIPMENT NEWS

cient quantity to furnish flood lubrication to the worm and wheel. The lower wheel-shaft bearing is always immersed in oil and has spiral grooves to insure the circulation of the oil.

On the larger, higher-speed sizes where fluid friction makes flood

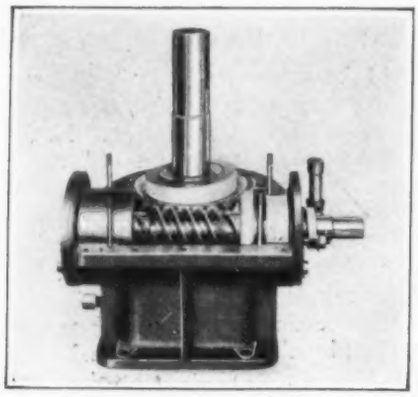


Fig. 2—The drive with cover removed

lubrication undesirable, a positive pressure oiling system is used to feed oil to all the bearings and to the worm threads and gear teeth at the contact points.

The drives can be had with the shaft extending either upward or downward.

Bilton "Pro-Ducto-Matic" No. 3½

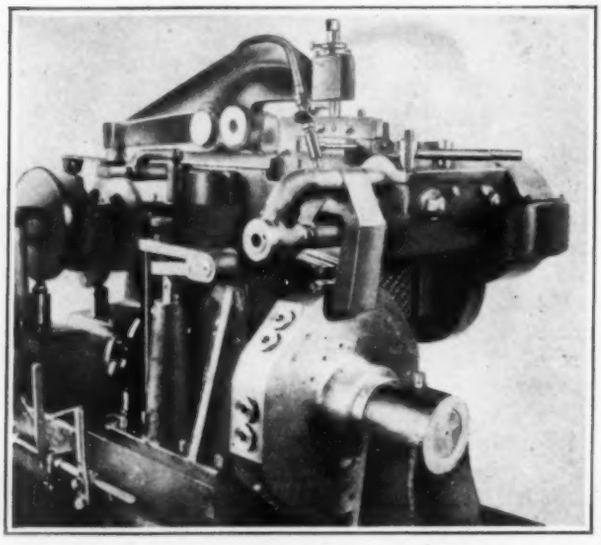
The Bilton Machine Tool Co., Bridgeport, Conn., has added to its line of "Pro-Ducto-Matic" milling machines previously described on pages 167 and 639, Vol. 63 of the *American Machinist*, the No. 3½, shown in the accompanying illustration. It is applicable to the work of slotting screws, slabbing one or two sides of bolt-heads, or similar work that can be performed by a single vertical movement of one or a gang of saws or milling cutters. It can handle round work up to 1 in. in diameter by 6 in. long, two pieces at one time.

A turret, or dial, mounted to swing in a vertical plane, carries upon its periphery eight pairs of bushings to hold the work. Each different diameter of shank to be held requires a full set of these bushings to suit, but no other holding fixture or jig is needed.

The work is loaded by the operator as each pair of bushings swings to an exposed position, but is held automatically, during the operation, by clamps that are adjustable to accommodate different thicknesses of head. The work is discharged by gravity as the loaded bushings swing to the lower arc of travel.

The cutter, or gang of cutters, is carried on a splined arbor in a spindle that takes its bearings in a head that is adjustably mounted on the face of the vertically-sliding member and driven directly by gearing. An overhanging arm, which is a part of the head, provides outboard support to prevent deflection of the arbor under a heavy cut.

The cycle movements are derived, as in all of this line of machines, from a horizontal cam-shaft mounted in bearings at the end of the main frame. The position of the shaft and the construction of the cams is such that the latter may be removed and others substituted without difficulty.



Bilton "Pro-Ducto-Matic," No. 3½

Ample provision is made for flooding the work with oil or cutting compound. The machine may be driven by belt or by an independent motor mounted under the frame. The floor space occupied is 48x60 inches.

"American" Magnetic Water-Proof Chuck

The waterproof chuck, illustrated in Figs. 1 and 2, has been put on the market by the American Hoist & Derrick Co., St. Paul, Minn.

The magnetic chuck is designed to hold castings and other parts for the purpose of grinding or machining them. It is shown, in Fig. 1, before loading and also after its face has been covered with work pieces, Fig. 2 showing a load in place.

The inside of the chuck around the coils is filled with oil under pressure. This oil acts as an insulating and water-proofing medium. In the event that a crack should develop in the walls, the oil will start coming

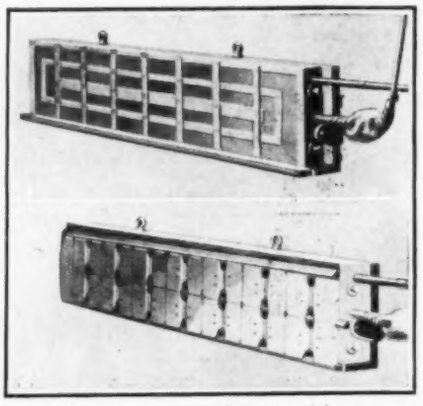


Fig. 1—"American" Magnetic Water-Proof Chuck
Fig. 2—The chuck loaded with work

out due to the internal pressure and will prevent the entrance of water. At the same time, the appearance of the oil on the outside will warn the operator of trouble before any damage can be done. The oil is also said to act as a cooling medium to keep temperature down on continuous use of the chuck.

Williams Pantograph Engraving Machine

The C. F. Williams Engraving Machine Co., 38 Chardon St., Boston, Mass., has recently placed on the market a small and compact pantograph machine for engraving letters, designs, dies and for similar work up to 3½x6 in. in size.

The cutter spindle is a standard Rivett head, fitted with draw-in collets to hold tools from 0 to ¼ in.

SHOP EQUIPMENT NEWS

in diameter. The tools are made from standard drill-rod. The spindle runs in hardened-steel sleeve bearings, and is driven through the medium of a round leather belt from a ¼-hp. motor mounted upon a bracket above the machine table.

The work table is 6x8 in. in size and has a vertical movement of 5 in. in a rigid guide-way. It is operated by a treadle. An adjustable stop limits the upward movement so that the work can be lowered away from the cutter and returned with certainty to its predetermined position by depressing the treadle. A clamp is provided to lock the table in its raised position when that is desirable.

The pattern table to the right measures 9x15½ in. and is adjustable in both directions. The stylus on

Williams Pantograph Engraving Machine

the end of the long pantograph arm has a vertical sliding movement against a light coil spring so that it can be depressed by the finger of the operator to bring it into contact with the engraved lines of the pattern.

The weight of the pantograph is supported by two swivelling steel casters that roll upon the planed upper surface of the main table and thus offer practically no resistance to the free movement of the pantograph. Both arms are adjustable to provide for various amplifications ranging from 3-to-1 to 9-to-1, so that dies can be cut that are from ⅓ to ⅛ of the size of the pattern. These adjustments are graduated to facilitate setting to any desired ratio.

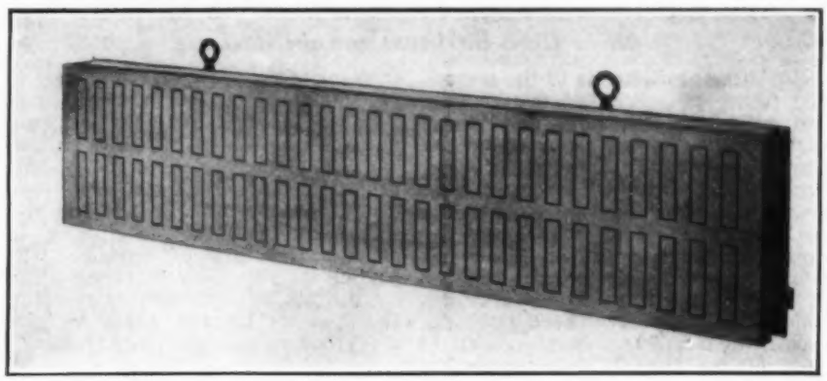
The features claimed for the machine are compactness, convenience and rigidity. The position of the stylus and pattern table in relation to the work is such as to bring them naturally under the right hand of the operator as he sits before the machine. The work is raised and lowered entirely by a movement of his foot, and his left hand is free to manipulate an oil can, brush or magnifying glass. Cuts ½ in. deep can be made in die-steels.

The machine occupies a floor space of approximately 2x3 ft. and weighs 485 lb. when crated for shipment.

Walker Magnetic Chuck 87-Inch

The O. S. Walker Co., Inc., Worcester, Mass., has recently brought out a magnetic chuck of unusual dimensions and construction to be used on a face-grinding machine.

The face of the chuck measures 18 in. high by 87 in. in length. The shell, or body, of the chuck together with the grid, or top plate, is a single steel casting. The magnets, 14 in number, are separate steel castings, each comprising a core and four pole-pieces.



Walker Magnetic Chuck, 87-Inch

The back plate is a slab of machine steel 15 in. wide by 87 in. long and 1¾ in. thick. Three special double-ribbed angle plates are included in the construction for attachment to the machine bed.

Report Shows Patent Office Is Improving

How the Patent Office is expediting action on the products of American inventive genius is described in the annual report of Thomas E. Robertson, Commissioner of Patents, submitted to Secretary Hoover last week. Increased expert staff, improved facilities, simplified procedure, and re-arrangement of office space made possible a notable gain in the time patent applications are held for official action. New patents were passed upon within an average of three months as compared with five months the preceding fiscal year,

The Patent Office was transferred to the Department of Commerce April 1, 1925. It had previously, for 76 years, been part of the Interior Department.

During the year the Patent Office handled applications totaling 103,705 as compared with 99,724 during the corresponding period in 1924. With the exception of the years 1921 and 1922, when patent applications withheld during the World War were submitted in large numbers, the number of applications filed during the period under review was the largest in the history of the Patent Office.

Detailed statistics show that applications for patents for inventions, designs, and reissues increased from 79,689 in 1924 to 82,213 in 1925; and trademarks, labels and prints from 19,885 to 21,378. Fees collected and turned into the Treasury amounted to $3,042,276, a figure larger by $228,977 than during any previous year in the history of the Patent Office.

Commissioner Robertson calls attention to the need for larger and better equipped facilities for the Patent Office. Citing in this particular the favorable recommendation of a Presidential Commission in 1912, he states that since that time the Patent Office has granted 500,000 patents or about one-third of all patents issued. He further recommends that the increased temporary staff authorized by Congress be continued.

News of the Week

President's Address Acclaimed by Trade Leaders as Clear Exposition of Relation Between Business and Government

Executive warns against foreign loans for purposes other than business rehabilitation

Radiating optimism as to the present and future prosperity of the country, and promising that the government would relax, so far as possible, the unnecessary annoyances to business, President Coolidge made one of the most brilliant and important addresses of his career before a gathering of prominent business men at the annual dinner of the New York State Chamber of Commerce, held at the Waldorf-Astoria Hotel, New York, on the evening of Nov. 19.

A call for friendly co-operation between the government and business, each in its own sphere; a warning to American bankers that it is their duty to see to it that American dollars loaned abroad are not used for military or unproductive purposes, and a plea for America to join the World Court, as its greatest possible contribution to mankind, were other high lights of the address.

Analysis shows that the President took up five major topics. They were:

(1) The service function of business.

(2) A sound policy for government regulation of business and the reasons therefor.

(3) The relation of tax reduction to the volume of capital available for production.

(4) Limitation of foreign loans to the development of industry and production.

(5) America's contribution through its financial aid to post-war rehabilitation.

What Is Business?

Mr. Coolidge, in his discussion of the function of business, made this very dear definition of the term:

"True business," he said, "represents the mutual organized effort of society to minister to the economic requirements of civilization. It is an effort by which men provide for the material needs of each other. While it is not an end in itself, it is the important means for the attainment of a supreme end. It rests squarely on the law of service. It has for its main reliance truth and faith and justice. In its larger sense it is one of the greatest contributing forces to the moral and spiritual advancement of the race.

"It is the important and righteous position that business holds in relation to life which gives warrant to the great interest which the national government constantly exercises for the promotion of its success. This is not exercised as has been the autocratic practice abroad of directly supporting and financing different business projects, except in case of great emergency, but we have rather held to a democratic policy of cherishing the general structure of business while holding its avenues open to the wildest competition, in order that its opportunities and its benefits might be given the broadest possible participation."

Privilege Not Practical

Praise for the broadness of industrial organization and the freedom attained by present-day business was conveyed when he said:

"It is my belief that the whole material development of our country has been enormously stimulated by reason of the general insistence on the part of the public authorities that economic effort ought not to partake of privilege, and that business should be unhampered and free. This could never have been done under a system of freight-rate discriminations or monopolistic trade associations. These might have enriched a few for a limited period, but they never would have enriched the country, while on the firmer foundation of justice we have achieved even more ample individual fortunes and a perfectly unprecedented era of general prosperity."

Toward the latter part of his address the President dwelt at some length on the financial situation in the world today, with particular reference to foreign loans and the funding of war debts. He laid particular stress on the help that has been given Austria, Great Britain, Germany, France, Italy and Belgium.

"These efforts and accomplishments," he said, "whether they be appreciated at home or received with gratitude abroad, which have been brought about by the business interests of our country constitute an enormous world service. Others have made plans and adopted agreements for future action which hold a rank of great importance. But when we come to the consideration of what has been done, when we turn aside from what has been promised, to examine what has been performed, no positive and constructive accomplishment of the last five years compares with the support which America has contributed to the financial stability of the world. It clearly marks a new epoch.

"This holds a distinctly higher rank than a mere barter and sale. It reaches above the ordinary business transaction into a broader realm. America has disbanded her huge armies and reduced her powerful fleet, but in attempting to deal justly through the sharing of our financial resources we have done more for peace than we could have done with all our military power. Peace, we know, rests to a great extent upon justice, but it is very difficult for the public mind to divorce justice from economic opportunity. The problem for which we have been attempting a solution is in the first instance to place the people of the earth back into avenues of profitable employment. It was necessary to restore hope, to renew courage. A great contribution to this end has been made with American money."

In conclusion he said: "This is the land of George Washington. We can do no less than work toward the realization of his hope. It ought to be our ambition to see the institutions which he founded grow in the blessings which they bestow upon our own citizens and increase in the good which their influence casts upon all the world."

To Simplify Screw-Thread Specifications

Manufacturers, machine supply dealers and other distributors, engineers, works superintendents, government representatives, purchasing agencies and others dealing with automatic screw-threading tools, have been invited to a conference to be held Dec. 4, in the Department of Commerce to act on proposals for the simplification of these commodities.

Invitations issued by the Division of Simplified Practice call attention to the fact that in this field many manufacturers whose major production is not less than 100 sizes, have been asked to furnish as many as 12,000 special sizes and combinations, none of which were in sufficient demand to justify the manufacture for stock.

A committee of manufacturers, after consultations with the National Screw Thread Commission, has drafted a tentative list of the essential minimum number of sizes. It is declared by the manufacturers' committee that the proposed list will cover the thread forms and pitches that are obtainable at the least cost of time and money.

The list includes regular stock sizes; threads for electric fixtures and fittings; railroad sizes in straight and taper and National standard pipe thread in straight and taper.

Steel Treaters Debate Merits of Alloys at New York Sectional Meeting

Manufacture, properties and heat-treatment are considered

A meeting of the New York chapter of the American Society for Steel Treating was held on the evening of Nov. 18, in the rooms of the Merchant's Association of New York City. The subject selected for discussion was "Alloy Steels" and it was divided into three parts—the special problems entering into the manufacture and inspection of the steels; the special properties of given alloys and alloy content for special service; and the special precautions required in working with and heat-treating the products made.

The method of presenting the subject was novel and entertaining, as well as highly instructive. Each speaker was a representative from a firm interested in a given alloy, the six being vanadium, nickel, molybdenum, chromium, manganese and tungsten. Each was given fifteen minutes to present his case and to show cause for the superiorities which he claimed, showing these causes in the presence, as one of the speakers said, of his op- as well as his proponents.

Large Increase in Use

George L. Norris representing the interests of vanadium opened the discussion. He stated that the uses of alloy steels in general have shown an increased production of over 400 per cent between 1909 and the present time, and that vanadium has played an important part in the development. He explained that while there are no special precautions required in making a vanadium steel, the ordinary care advisable in making a high-grade product should be exercised.

He stated that a vanadium steel is a good material from which to make tools, that it responds uniformly to heat-treatment, that it has the valuable property, in forging work, of retarding grain growth at elevated temperatures, that it retards crystaline segregation and that it results in an alloy steel which is resistant to wear and errosion.

He further stated that chrom-vanadium alloys under 20-point carbon are suitable for parts requiring case-hardening and that the alloy with carbon between 25 and 30 points is largely used for automobile parts. He named many other uses and corresponding percentages of the alloy that would give the best results, and stressed the advantages to be gained by scientific rather than haphazard heat-treatment.

Charles McKnight, Jr., then took the floor and read a paper on the subject of nickel alloys. Due to the fact that nickel is not lost in the steel making and due to its complete recoverability nickel scrap can be used in the melt to a per cent as high as 50. The nickel is not a curative agent, according to Mr. McKnight, and pipes and blowholes resulting in the ingots through careless work will not weld up. He stated that the scale tends to be tight in rolling and that proper steps and precautions should be taken on this account.

He mentioned the criticisms directed at nickel steels and pointed out that investigation has shown the steel-making practice, principally during the war, to be the true seat of the troubles encountered.

He outlined the particular uses of the alloy in varying quantities. The first range he stated to be between ¼ of one per cent to 5 per cent. The next, an unuseful range, is between 10 and 20 per cent. A third, between 22 and 27 per cent produces a non-corrosive alloy. At 24 per cent, the alloy is non-magnetic. Between 24 and 32 per cent it has high electrical resistance. At 36 per cent it carries the well known name of "Invar" having a very low coefficient of expansion. At 46 per cent the alloy is known as "platenite" and has the same expansion coefficient as platinum and glass. At 46 per cent it is known as "permaloy" and finds use in radio transformers and deep-sea cable sheathing among others.

He stated that nickel adds strength and toughness to steel with a corresponding excellent resistance to fatigue and impact. In combination with molybdenum it can be case-hardened to advantage and is useful in bridge work, ship plate and boiler construction.

He discussed the subject of heat-treatment and the working of the nickel steels and stated that, while it cannot be hammer-welded, this drawback is overcome by use of the torch, the arc, or electrical-resistance welding. In machining, it is advisable to double the cutting speeds over those correct for wrought iron. In heat-treatment, nickel content has the effect of lowering the critical point but ample time should be given for complete penetration of the heat, and an initial normalizing treatment is desirable. He stated that, properly made, nickel-steel castings when heat-treated compare favorably with forgings.

Use of Molybdenum

John D. Cutter then told of molybdenum being the youngest of the alloy family and traced its progress to the present time, relating interesting points on the source of supply at Climax, Colorado. Its first commercial use was in making the brackets upon which lamp filaments were wound. It was then used in the metallic form. Now it is made for introduction as a salt into steel baths.

Mr. Cutter stated that the result was much the same as tungsten in imparting hardness to high-speed toolsteels. It is used also as a steel toughener. He spoke of the advantage of using a salt form in its effect on the final result.

When heat-treated, a molybdenum steel has characteristics which resist impact loads, and shows excellently in wearability. It is used largely in the bearing industry for balls, rollers and races. The scale is free-flaking and the steel is machinable. The alloying substance is low priced and the steel can be used for all classes of fabrication.

Mr. McGrigg, representing chromium, followed Mr. Cutter. He dwelt on the advantages to be gained by careful making and treatment of any alloy steel.

He stated that it was best practice to add chromium after the steel bath had become quiet, the addition needing care to distribute it uniformly throughout the bath. A chromium steel should also be teemed while hot as it is not so lively as carbon steel. Otherwise surface defects may occur similar to those in the average alloy steel. It should not be left for a length of time in the molds and should be stripped hot and put into a soaking pit before rolling.

He spoke of the groups into which various chromium contents can be divided. One, 12 to 13 per cent chromium results in a stainless and rustless steel, another at 2½ per cent shows high ductility and a high elastic limit with remarkable resistance to shock. A combination containing 20 to 35 per cent shows high resistance to oxidation without heat-treatment. It further shows marked strength at high temperatures. It has the property of improving metal hardness through the steel section upon heat-treatment.

Qualities of Manganese

John H. Hall spoke next for manganese stating that one of its principal advantages was the adding of strength to steel at low cost. Toughness and strength are the principal results of using the manganese. He said that one per cent of manganese was the equivalent in its results of 2 per cent of nickel, raising the elastic limit without sacrifice of strength. It loses weight when added to the bath, a portion going to purge the steel of impurities. With 1¼ to 1½ per cent of manganese in a 40 carbon steel a normalizing and reheating operation promotes air hardening and renders quenching in liquid and drawing back unnecessary. He remarked on the increasing use of manganese in steel at 1 to 2 per cent. A 2½ per cent manganese and 50 carbon air hardens to file hard but can be annealed to show a 15 per cent elongation.

Another class, and one perhaps better known, was touched on as comprising those steels containing 11 to 13 per cent of the alloying material. This manganese steel is used largely on switch points and railroad crossings on account of its property for resisting heavy wear and impact.

A. H. Kingsbury completed the talks by covering the subject of tungsten. He discussed the making and heat-treatment and stated that this steel is not suitable for structural use.

Tungsten has the effect of refining the grain of steel and the steel is used largely in all manner of metal-cutting tools on this account. Mr. Kingsbury spent some time in discussing the true meaning of the definition of hardness and pointed out the errors that are common in this respect. He warned against leaving the steel for too long a time in the heat as there is a tendency toward rapid grain growth. He then further discussed the desirable properties of the alloy in tools for industry.

Safety Conference Hears Reasons for Increase in Industrial Accidents

United States leads nations of world in total deaths

One of the startling facts brought out at the New York Safety Conference held on Nov. 18 at the Engineering Societies Building, was that the United States lost last year 860 persons per million by accidental death, as against 496 for France, 452 for Great Britain, 446 for Japan and 332 for Denmark.

At the morning session, at which Kingsley L. Martin, presided in the absence of Dr. Durand, C. B. Auel, past president of the National Safety Council, in the opening address, pointed out that our larger number of accidents added to the cost of living, added to taxation and seriously threatened our position as a nation.

A. L. Dickerman, vice-president of the American Car and Foundry Co., traced the compensation idea back to the guilds and stated that the feeling had always existed that the "hirer must protect the hired." He showed that German activity in behalf of workers was based on the desire to secure better men for the army and that Bismarck in 1885 advocated that more attention be paid to this phase of industry. It is to the credit of manufacturers in this country that the safety movement had been established by industry itself. He urged that it be constantly kept in mind and that the basis be the saving of life rather than money.

Prof. Walter Rautenstrauch gave a startling example of the large accidental death rate by stating that, while the conference was in session during the day, a number equivalent to the whole audience would be killed in industrial accidents. He further pointed out that no statistics could give the full cost of accidents, as human happiness could not be so measured, and that the preservation of human happiness was the greatest moral principle and obligation. He said that as war was the greatest destroyer of happiness it seemed futile to strive to save life only to throw it away wholesale in international strife.

L. P. Alford, while appreciating what had been done, attributed many accidents to improper teaching of men, lax supervision, and particularly to the fact that too many high executives have not been aroused to their interest and responsibility in safety work. There was also a paper on "Organization and its Work in Accident Prevention" by J. G. Waller, vice-presdient of the New York Central lines.

At the afternoon session C. E. Skinner, director of standardization, the Westinghouse Electric and Manufacturing Co., spoke on "Engineering Standards and the Safety Movement," in which he stated that civilization demands new machines which involve new hazards that are usually not anticipated. The desire to operate machines at maximum speeds necessitates the use of guards and other safety devices. A standardization of the safety methods used is especially necessary as the hazards increase. Safety codes give maximum safety with opportunities for commercial growth. Safety pays from all standpoints.

In discussing Mr. Skinner's paper, C. P. Tolman stated that he had never known a case where safety did not pay better than any other activity, and cited instances where safety devices made it possible to increase the speed of presses, while removing all dangers. In one case the installation of a dust exhaust system in a chemical plant paid 30 per cent in the saving of the dust alone. But safety not only pays dividends but is the greatest spiritual movement in industry.

L. A. DeBlois pointed out the three phases of safety—guards, education and the elimination of the hazard. As the latter is the most important it should be tied up to engineering design. While many accidents are due to carelessness, they can usually be eliminated by other means such as designing machinery so as to make them impossible. Dean Holbrook of the School of Mines, Pennsylvania State College, presented a paper on "Safety Education in Schools and Colleges," and showed how few colleges gave it serious attention, only six featuring safety courses. Safety teaching, in his opinion, should be a part of every course, and not a course by itself. The teaching of safety should begin in the public school and in the home. This view was also taken by J. D. Keller who spoke of the good work being done by the University of Cincinnati and the University of Illinois. A. W. Whitney, associate manager, National Bureau of Casualty and Surety Underwriters, told of the work of his organization in furthering instructions in safety work in the public schools. They now have three field secretaries who have aroused widespread interest in the safety movement, which in his opinion, is in the broad sense, a part of one's attitude toward life.

"The Prone Pressure Method of Resuscitation" was discussed and demonstarted by E. W. Ashe and commented on by others. The evening session was devoted to safety in mining and the standardization of safety work.

National Founders Association Is Host to Conference on Tax Reforms

Better understanding between industry and agriculture

A national conference on economy in state and local administrative expenditures and the reduction of state and local taxes between leading representatives of industry, agriculture and transportation was held at the Hotel Astor, New York, on Nov. 18 and 19, under the auspices of the National Founders Association.

The conference was a part of the comprehensive program of the movement "Better Understanding Between Industry and Agriculture," with which the National Founders Association, the National Metal Trades Association, the National Grange and the American Farm Bureau Federation, are affiliated.

The specific purpose of the conference was to discuss practical methods of promoting economy in taxation, and speakers of national prominence were invited to present the views of their respective industries and trades.

Of particular interest to this industry was the address by R. H. Aishton, president of the American Railway Association, whose subject was "How Taxes Affect Railroad Costs."

Referring specifically to the importance of a reduction in railway taxation, Mr. Aishton said:

"The present taxes on the railroads of this country are a burden and a growing burden. In view of the fact the return realized by the railways of the country under the level of rates determined by the Interstate Commerce Commission has fallen materially below the standard of a fair return set up in the Transportation Act of 1920, this low level of return makes the increasing burden of taxes increasingly hard to bear.

"This burden of railway taxes does not stop with the total amounts charged against the railways by the various governments, and paid necessarily each year. There is an added burden in the fact that railways especially are subjected to a great variety of forms of taxation.

"All of these taxes and charges, beggaring description in their variety, burdensome and increasing steadily in amount from year to year, have been imposed by legislative bodies with little or no regard to equity or theory.

"Not only does this multiplicity of the taxes levied on the railways create confusion, duplication and many inequalities as between corporations and regions, but adds another important element to the cost of railway operation in the expenditures required for the preparation of special reports, the filing of countless forms with governmental tax and other agencies, and the cost of the accounting for such reports.

"Railway taxes more than doubled from 1916 to 1924, while in 1925 they are averaging almost exactly one million dollars a day or approximately $42,000 per hour. Taxes paid in 1925 are an increase of nearly 6 per cent over the amount paid in 1924 in which year they totaled $340,000,000. The amount paid in 1924 was an increase of $84,000,000 or 30 per cent over 1921.

"While railway taxes have been constantly increasing, there has been a reduction in freight rates during the four years since 1921 that has averaged

more than 13 per cent. During the year 1924 alone, and based upon the freight traffic handled in that year, the shippers of the United States paid a total freight bill smaller by more than $600,000,000 than they would have paid had the freight rates of 1921 remained in effect without reduction. This reduction has been made possible through large additions in capital investment, which have resulted in increased efficiency and economy in operation.

Getting down to the foundry industry, H. M. Lane, president of the H. M. Lane Co., of Detroit, addressed the conference on "The Need for Improved Foundry Methods to Overcome Foundry Labor Shortage." Mr. Lane dwelt at length on the progress that has been made in the perfection of foundry machinery and referred to this progress as one way in which to overcome the apparent shortage of skilled foundry labor.

Other speakers and their subjects were: William H. Barr, president of the Founders Association, on "Why This Conference?"

"Who Pays the Taxes," by James A. Emery, general counsel of the association.

"Taxation: The Great American Crop," by W. J. Thompson, of the National Grange.

"Taxation: The Family Burden," by Allan Robinson, president of the Commonwealth Bond Corporation, New York.

"Tax Control Through State and Local Expenditures," by C. A. Dyer, president of the Lower Taxes - Less Legislation League.

At the conclusion of the conference routine business of the Founders Association was transacted. Only one resolution was adopted, and that urged the members to do all in their power to secure the repeal of the Miners' License Law and the recognition of the principles of the Anthracite Award of 1903.

William H. Barr was re-elected president of the Association. L. R. Clausen, of the J. I. Case Threshing Machine Co., Racine, Wis., was elected vice-president. A. E. McClintock, of Chicago, was re-elected commissioner and J. M. Taylor secretary.

Location of Oil Hole Is Vital

The efficiency and life of plain bearings depend largely upon the proper location of oil holes. That point was stressed by both speakers at the meeting of the Metropolitan section of the Society of Automotive Engineers, Nov. 19, at the Empire Hotel, New York City.

D. P. Barnard, 4th, of the Standard Oil Co. of Indiana, and H. A. Howarth, of the Kingsbury Machine Works, Frankford, Pa., were the speakers.

Mr. Barnard showed a moving picture of colored oil in a glass bearing, to prove the existence of the oil film between bearing and journal and to indicate the path of the oil as the journal revolves.

The test showed clearly that the oil should enter the bearing at an unloaded point. It showed also that when the oil hole is located at the loaded point the oil may not be able to enter the bearing.

In the test, when the load was shifted 180 deg., while the bearing was full of oil, a reverse action took place that forced the oil from the bearing back into the supply tube.

The broken-up condition of the oil film upon starting and stopping was demonstrated in the picture. From what was seen it is apparent that the greatest wear on the bearing occurs during starting and stopping.

Mr. Howarth demonstrated a thrust bearing operating without lubricant except air, and without contact of the metal parts during operation. By means of an electric light operated by a battery it was proved that there was contact between the two parts of the bearing while at rest, but that there was no metallic contact while running above very low speeds.

Chicago to Have Largest Machinery Mart in World

Plans are rapidly being completed for the construction in Chicago of what is expected to be the largest machinery mart in the world. The illustration here gives a general idea of the proposed project, which will be built with

a frontage of 150 ft. on Canal St. and extending back 320 ft. to Clinton St., where it will have a frontage of 115 ft. The building will be twenty-one stories high, and will house a permanent exhibit of machine tools and machinery. There will be a convention hall capable of seating three thousand people.

It will be occupied by manufacturer's agents, machine tool dealers and those in other ways associated with this industry. The tenants will eventually become owners of the building.

It is expected that construction will start shortly after the first of the year and the building will be finished in May, 1927. Charles A. Dean, of 14 East Jackson Blvd., is in charge of the project..

Government Officials Stress Importance of Motor Truck

The importance of the motor truck as a national resource in both times of peace and war, and the means by which the motor truck may extend its influence, were brought out graphically by a number of government speakers to a hundred or more motor truck manufacturers, motor engineers, body and parts builders at the convention of the Motor Truck Industries, Inc. The sessions were held in the Department of Commerce at the invitation of the Division of Simplified Practice, which is co-operating with the association, on Nov. 18 and 19.

J. W. Stephenson, of the Indiana Truck Corporation, and president of the organization, presided. The delegates were welcomed by R. M. Hudson, chief of the Division of Simplified Practice, who outlined the contrast between transportation of a century ago and that of today, and who emphasized the need of greater attention to standardization work if the motor truck industry is to give its greatest measure of service to the public. Assistant Secretary of Commerce J. Walter Drake told the delegates of the efforts of the Department of Commerce to help commerce and industry to market its goods in foreign fields; and described other services of the department.

Colonel Chauncey B. Baker, U.S.A. retired, of Columbus, Ohio, who was in charge of motor transport during the World War, pointed to the army as an example of standardization in every phase of activity. In the war, he declared, the standardized military truck used by the United States Army and produced in parts by 147 manufacturers, was in service 95 per cent of the time. This was due to interchangeability of parts. In contrast he cited the experience of another nation, which had 17 varieties of motor trucks and which had but 25 per cent of its trucks fit for use and which necessitated the setting up of a large factory repair force.

Recommendations as to the specifications on four standard models of trucks were presented by P. J. Spraker of the Atterbury Motor Truck Co., chairman of the committee on ratings.

Discussions indicated that the trend of demand from fleet owners is for parts which shall be interchangeable, so that entire units may be replaced, while the damaged parts are repaired by bench mechanics, withholding the trucks from service only for the time necessary for replacement. This trend, it was indicated by C. D. McKim of Continental Motors Co., Detroit, has been due to the growth of the bus transportation. Such an interchangeability, declared B. S. Gramm of the Gramm-Bernstein Truck Co., would have a tremendous influence in the favor of the public, and would also affect the attitude of the 400 bankers who are in touch with the industry.

Reports were presented by the committee on motor and motor accessories, and on steering gears and controls.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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THE rediscount rate of the New York Federal Reserve Bank remains unchanged at 3½ per cent. That this fact should take the leading rôle in the week's financial drama is an interesting commentary on the present state of Wall Street's nerves. In itself the prospect of an increase of one-half of one per cent in this rate seems relatively unimportant, but, in the minds of stock exchange speculators, it recently assumed the proportions of a nightmare, a relentless Nemesis whose pursuing feet came closer every day.

All of which goes to prove that the stock market, in its recent speculative enthusiasm, had gotten so out of touch with reality that almost any little thing could upset its equilibrium, and not that the Federal Reserve Bank bears any real resemblance to the sword of Damocles hanging by a thread above its victim.

But, although the New York bank failed to take any action on its rate last week, the warnings of the Federal Reserve Board to speculators have apparently had the desired effect. Last week the previous example of the Federal Reserve Bank of Boston in raising its rate from 3½ to 4 per cent was followed on Monday by the Cleveland bank and on Thursday by the Philadelphia bank.

Consequently, the speculative ardor of the public has been dampened and the decline in stocks has largely discounted the effect of an increase in the New York rate. Meantime, the atmosphere on the stock exchange has become more wholesome and the prospect of an increase in the rediscount rate here is now contemplated with comparative equanimity. The present interest in the question is chiefly the result of the earlier state of mind when it appeared all-important.

Just as the earlier speculative advance of the stock market bore little direct relation to the actual conditions of business, so now the present reaction appears to be without significance as a barometer of trade. In fact, many observers believe that business should improve with greater uniformity and wholesomeness, now that the excess air is escaping from stock values without the necessity of a dangerous explosion.

The iron and steel industry continues to report encouraging progress. Operations in steel are now at 85 per cent of capacity, and prices show no tendency to weaken. Copper quotations are slightly lower due to a disappointing export demand, but domestic consumption of copper is said to be improving steadily in most localities.

Freight car loadings still remain above a million cars a week despite smaller grain shipments and the loss of coal traffic. New building contracts reported last week show a moderate decline but this fact should be encouraging rather than otherwise. The unprecedented rate of new construction has been another cause of worry for conservatives and a slight let-up in the pace should indicate greater stability.

Our foreign trade figures are also satisfactory. The report for October shows an export balance of $117,000,000, as compared with the $70,000,000 favorable balance in September. Although the current export balance is approximately $100,000,000 less than the corresponding figure for October, 1924, it is interesting to note that our total foreign trade is $30,000,000 greater than a year ago, chiefly because of the marked increase in imports.

The speculative commodity markets continue to ignore the change of sentiment on the stock exchange and have generally shown a remarkable firmness.

In the cotton market the weeks are now divided into pre-government-report and post-government-report weeks. Last week was a pre-government period and trading generally was of a limited character. Quotations had a strong undertone, however, on the belief that the world is willing to take all the cotton that has been produced at prevailing prices.

Wheat rose several cents as the result of less favorable crop reports from the Southern Hemisphere, and the leading other grains were sympathetically strong. Rye is now attracting considerable attention because of its wide discount under wheat. Available supplies in the United States are small and could easily be exhausted by an increase in domestic consumption.

The expected loan to Italy for the purpose of stabilizing the lire was announced last week by J. P. Morgan & Co. in the shape of a $100,000,000 bond issue. The bonds, which were quickly absorbed by the public, bear interest at 7 per cent and were offered at 94½.

European developments have been without particular significance for American business. Great Britain is beginning to throw out her chest a little and realize that her industrial future is not so dark as some of her prophets have been painting it. France, on the other hand, is still struggling with her financial problems.

Festina lente, "make haste slowly," is a Latin proverb whose applicability to business at present is most evident. The dangers of inflation are still with us despite the readjustment in the stock market.

What's Doing in Industry

The trend of machine tool and machinery sales is upward. Figures available at this time of the month indicate that November will rank among the best three months of the year. So far October holds the honors as being the best thirty-day period.

The feature of present buying is the large number of individual orders, each calling for one, or possibly two, machines. Orders are scattered, indicating country-wide activity. General manufacturing sources furnish the bulk of this business.

For the first time this season Detroit reports a slight slowing up in orders, although expansions in automobile plants give promise of considerable business when plans are completed. Cincinnati manufacturers are quite busy and new orders have increased during the past week. Chicago reports a steady volume, although new inquiries have fallen off slightly.

Southern prosperity has been reflected in all lines, and machinery sales have increased substantially. In Philadelphia business is on the upward trend. Milwaukee reports more actual orders but fewer new inquiries.

Many observers believe that business should improve with greater uniformity and wholesomeness now that the excess air is escaping from stock values without the necessity of an explosion.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New York

Total sales figures for November are not yet available, but in all probability they will not be as large as October. New orders continue to appear from unexpected sources, and new inquiries that have been issued, while they are mostly for single pieces, are nevertheless numerous enough to add considerably to the optimism that pervades this market.

The manufacturing industries represent the best customers at this time. The electrical, hardware and building supplies trades are busy and this has been reflected in increased sales to customers serving these trades. Steel fabricators are also riding on the wave of building construction sweeping this market and sales of machinery to this source have increased.

The export market has picked up and is expected to reach favorable proportions by the end of the year. Russia in particular has been in the market for machine tools, and inquiries now under way will show this country one of the best export customers of the year.

Orders placed here in the past week show a tendency on the part of buyers to seek special machines for higher production work. Single pieces for certain specified work are in popular demand.

The second-hand market is dull, only standard machines being salable.

Cincinnati

The feature of the machine tool business in the past week, according to Cincinnati manufacturers, has been the booking of an increased number of single orders. While no large lists have been ordered and while the sales were largely confined to single tools, the aggregate of the orders constituted a substantial increase.

This business is said to have come from all sections of the country, the orders calling for all types and sizes of tools. The heaviest buyers were concerns in the automotive industries. Most of the equipment sold to general machinists consisted of labor-saving types, bought for replacement and to reduce costs.

Railroads did more buying than in the previous week, but the orders were confined to replacements. There is a persistent rumor that two railroads are about to order large lists that were submitted to manufacturers some time ago.

Practically all machine tool plants are working full time with good-sized forces, some have increased their forces, and one plant is working overtime, its output for the next thirty days being sold.

Philadelphia

The upward trend of business in the machinery and machine tool lines, which became apparent some weeks ago, has been maintained throughout the Philadelphia area, according to reports from dealers and manufacturers.

Up to the present time, however, there has been no indication of the approach of a large volume, and nothing in the inquiries received by larger producers indicates the coming of such a condition. On the whole, however, the situation is as satisfactory as had been anticipated earlier in the season.

The larger industries report they are not contemplating an early entry into the market for large purchases. The Pennsylvania Railroad Co. reported the usual number of replacements such as shapers, planers and drills, but nothing has come through in the way of prospective buying in quantities. Inquiries have been received from a number of industrial centers, but the Middle-West appears to be leading in the number of requests for information concerning purchases.

The smaller dealers in new and used tools, as well as engineers specializing in repairs and designing, report a spotty business, which has shown a tendency toward increasing.

Chicago

While there has been a slight falling off in the demand for machine tools in this market during the last week, it has not been sufficiently marked to cause disquiet in the trade. Reports are to the effect that although the volume of business now being transacted is not quite equal to that which characterized the beginning of November, it is satisfactory; and in view of the fact that many of the inquiries received during October are yet to be acted on, the situation is generally regarded with optimism in respect to the remainder of 1925.

Such decline in demand as has recently been experienced applies more particularly to used equipment, the call for new standard tools showing practically no diminution.

There has been some rumor of an advance in prices for certain metal-working machine tools, but inquiry fails to develop any sound basis for such rumor.

A number of Chicago dealers in used machinery are in Indianapolis this week attending the receiver's sale of the equipment of the Midwest Engine Co.'s plant, which includes a great quantity of tools of various descriptions.

Detroit

Although Detroit representatives of machine tool and machinery manufacturers report business as fairly brisk in this territory, there is a tendency to look to the future and consider what 1926 has to offer them.

Recent announcements of large extensions on the part of the Ford Motor Co., the Cadillac Motor Car Co., the Buick Motor Co., the Oakland Motor Car Co., the Hudson Motor Car Co., and several other automobile manufacturers, serve as a foundation for the belief that the coming year will find the machinery field in southeastern Michigan in the best condition it has ever enjoyed.

Buick has appropriated some two millions of dollars to be used in increasing its production to 1,200 cars daily. Most of this appropriation will be expended for additions to present buildings, and for machine and tool equipment, conveyors, etc.

This figure of two millions is topped by the Cadillac announcement that three millions will be expended for additions to its manufacturing facilities. Chief among the new developments will be the construction of a new assembly building which will mean the expenditure of hundreds of thousands for new machinery.

An enlargement of its factory at Pontiac, Mich., and an increase in equipment costing $500,000 has been announced by the Fisher Body Corporation.

The purchase of $250,000 worth of new machinery to be used in stamping metal at the company's smaller plant is also contemplated.

One hundred thousand dollars will be spent in additional buildings and equipment by the Wise Industries, of Detroit, makers of "acorn" nuts for the automobile industry and specialists in electro-sherardizing and nickel plating.

Southern District

With general conditions in the South described by leading business interests as eminently satisfactory, and the district unquestionably facing an era of prosperity, there is promise that machine tool dealers are facing one of the best winter seasons they have ever enjoyed.

In most of the important buying fields in this district sales have continued to note a steady improvement for a month or two past. Business the first half of November was better than the corresponding period of October, and also better than the first part of the month last year. Inquiries are in sufficient volume to indicate that sales will continue to hold up on this same basis through the rest of the month.

There has been hardly any abatement in construction activity anywhere in the South, and contracting machinery is in particularly good demand. Business is unusually good for this line in Florida, but the embargo situation there is affecting the shipments into that state.

The larger Southern railroads also continue to buy well of heavier tools and shop equipment, and indications are that this business will continue more or less active through the winter months.

Due to the general improvement in sales the past two or three months, and the good business enjoyed the early part of the year, dealers in this section believe that 1925 will prove one of the best years they have enjoyed in the past half decade.

Milwaukee

Despite the fact that inquiry has shown a tendency to slow up, there is not the slightest suggestion of a feeling of discouragement in the local metal-working equipment trade. Dealers' sales are well sustained, while bookings by the manufacturers are of sufficient volume to maintain operating schedules without disarrangement. Practically all shops are manned at the highest number reached within a year's time, and it is not always possible to procure the requisite number of skilled men, due to the general absorption of this class of labor in recent months.

The most significant of developments, which is the unusually wide diversification of the sources of business, continues in effect and adds materially to the cheerfulness of sentiment. For many months the automobile industry ranked above all other groups as the most extensive customer, but it is no longer so dominant, with other lines experiencing an expansion of business that is requiring greater means of production. A case in point is the fact that International Harvester is starting work on a large addition to its Milwaukee works which is the first construction of any importance found necessary in nearly five years.

The foundry trade reports the business volume less spotty and a number of the most important concerns are expanding, although this is predicated largely upon plant replacement or modernization.

Acetylene Association Studies Welding

Modern problems of welding, and the discussion of the latest developments in the use of oxy-acetylene were the high lights of the twenty-sixth annual convention of the International Acetylene Association, held in Chicago, Nov. 18, 19 and 20. Several hundred members of the association and others interested in the industrial applications of acetylene welding and cutting, were present.

In his address "Procedure Control in Welding," L. E. Ogden, vice-president of the Oxweld-Acetylene Co., called attention to a recent development of utmost importance to all organizations using the oxy-acetylene welding and cutting process. Realizing that the highest efficiency can result only when the welding operations are intelligently controlled, the principles of production engineering have been applied in formulating a set of fundamental principles to be known as a "procedure control for welding."

W. A. Slack, of the Torchweld Equipment Co., discussed the engineering features involved in "Surveying An Industrial Plant and the Installation of Oxygen and Acetylene Piping."

In a paper on "Welding on Carbon and Alloy Steel Tubing for Aircraft," T. B. Johnson, chief of the materials section, engineering division, the Army Air Service, brought out the interesting part that all of the new designs of airplanes used by the United States Army from the smallest 2,200-lb. racer to the 12,000-lb. bomber, have welded steel fuselages.

Characterizing the oxy-acetylene welding and cutting process as the greatest development in the shipbuilding industry, Commander H. E. Roselle, Construction Corps, United States Navy, told how carefully planned application of the cutting process made possible the profitable scrapping of five warships at the Philadelphia Navy Yard.

That the modern steel foundry would be placed under an almost unsurmountable handicap if deprived of the oxy-acetylene cutting process was the thought expressed by R. W. Thomas, superintendent of the steel foundry, Vulcan Iron Works. In his paper "Influence of Oxy-Acetylene Cutting on Steel Foundry Practice," Mr. Thomas showed how the use of this process had revolutionized plant practice.

News of the Automotive Industry

Alfred P. Sloan, Jr., president of the General Motors Corporation, announced last week that three representatives of General Motors have been added to the board of Vauxhall Motors, Ltd., of Luton, in which General Motors has acquired an interest.

"Negotiations which have been under way between Vauxhall Motors, Ltd., of Luton, England, and the General Motors Corporation," Mr. Sloan said, "were finally consummated on Nov. 16 through the approval at an extraordinary meeting of the stockholders held for the purpose. The board of directors was increased from four members to seven, the additional three representing General Motors.

"The Vauxhall company will continue exactly as at present under the same management with no change whatsoever in general operating policies."

Following the recent announcement that the entire output of the Franklin Automobile Co. up to Jan. 1 was sold out on Oct. 20, and that the dealer orders placed with the factory at this time indicated an over-demand in many respects, the Franklin company made immediately effective an increasing production schedule which will attain a maximum of 67 cars per day. With the report of Franklin's enlarged production program also comes statements by factory executives that business in every section of the country is extraordinarily good.

The Cadillac Motor Car Co., a division of the General Motors Corporation, established a new high record in October with production of 3,200 cars. Lawrence P. Fisher, president of the company, states that it has more unfilled orders on hand than at any previous time. The company has appropriated $3,000,000 for additions to its manufacturing and retail facilities.

In accordance with the usual seasonal reduction in manufacturing activities, the Studebaker Corporation production schedule for November will approximate 10,000 cars, as compared with approximately 14,000 cars in October. December program calls for 6,000 cars as the plants at South Bend and Detroit close for inventory the last half of the month. As Studebaker operated at practically close to capacity from March 1 to well into this autumn season, the tapering off is a natural development designed to prevent the overstocking of dealers.

The demand for coaches and sedans has necessitated material changes in Oldsmobile's production plans. Additional floor space and rearrangement of shop layouts have been made necessary. The most important change made was the taking over by the Fisher Body Corporation of an additional group of buildings comprising over 60,000 sq.ft. of floor space for production of bodies for Oldsmobiles. These increased facilities in the Fisher plant, together with extensions and expansions in the Oldsmobile factory, will make it possible for Oldsmobile to double its production by January, 1926.

What the Railroads Are Doing

The Sante Fe has placed an order for an additional 20,000 tons of rails, divided equally between the Illinois Steel and the Inland Steel companies, and bringing the total placed by this road to 94,000 tons; the Baltimore & Ohio placed about 35,000 tons with the Bethlehem Steel, 38,000 tons with Carnegie, 7,000 tons with Illinois Steel and 5,000 tons with Inland. The Missouri Pacific placed 20,000 tons with the Tennessee Coal, Iron and Railroad Co., 10,000 tons with the Colorado Fuel and Iron, 7,000 tons with Illinois and 3,000 tons with Inland. The Tennessee Coal, Iron and Railroad also booked an additional 10,900 tons for the Cotton Belt.

The 45 locomotives for the Atlantic Coast Line which were booked by the Baldwin Locomotive Works, are in addition to 8 switching engines which were sold last week, and brings total locomotives to the Coast Line on this order to 113. Delivery on the 45 engines will be started in December and will result in shop operations being built up to 40 per cent as against a current rate of 35 per cent. Orders are valued at about $2,250,000 and call for 10 switching engines, 5 heavy freight engines and 30 Pacific type which can be utilized in either passenger or fast freight service. Baldwin this month will finish delivery on the 60 locomotives ordered by the Coast Line some time ago.

Baldwin has also received an order for four steam locomotives for Brazil, and has been selling parts to Roumania.

Work of removing the frame shop from Philadelphia to Eddystone, which was started last August, will be finished in January. The new frame shop is being housed in one of the buildings formerly used by the Eddystone Munition Co., which has been remodeled.

The American Locomotive Co. booked four mountain type locomotives for the Tennessee Central Railway. The Central of Georgia ordered five of the same type from the Baldwin Locomotive Works.

The Wabash is in the market for 25 switching engines, and the Norfolk & Western for ten mountain type locomotives.

Ralph Flanders Before A.S.M.E. Section

A dinner meeting of the New Britain Section of the American Society of Mechanical Engineers was held in the state trade school building at New Britain, Conn., on the evening of Thursday, Nov. 19. The guest of honor and speaker of the evening was Ralph Flanders, general manager of the Jones & Lamson Machine Co., of Springfield, Vt. Mr. Flander's subject was "Developments of Automatic Machinery," a subject upon which he is especially well qualified to speak. His talk was illustrated by lantern slides showing various types and classes of automatic machinery. About 80 members were present.

Personals

C. R. BURT has been appointed vice-president and a director of the Pratt & Whitney Co.

C. E. NELSON has been appointed advertising manager of the Stanley Works, New Britain, Conn.

WILLIAM L. ABBOTT, chief operating engineer for the Commonwealth Edison Co., of Chicago, has been elected president of the American Society of Mechanical Engineers.

JOHN S. SCOTT, who has been sales manager of the Middle-West district, for the Patterson Foundry Co., East Liverpool, Ohio, has been made secretary of the company.

E. A. COWLES has been elected president of the Cowles Tool Co., of Cleveland. Mr. Cowels succeeds the late H. S. Hunter. He will also act as general manager of the plant.

JAMES R. THOMPSON has been appointed works manager of the Trafford foundry of the Westinghouse Electric and Manufacturing Co. Mr. Thompson has been associated with the company for the past thirty years.

P. H. MCGREGOR, formerly general superintendent of the Oakland Motor Division of the General Motors Corporation, Pontiac, Mich., has become plant superintendent of the Chevrolet Motor Co., at Flint, Mich.

JOSEPH E. BOYD, who has been superintendent of the Lower Works of the Patterson Foundry Co., East Liverpool, Ohio, has been made general superintendent with entire charge over manufacturing and with supervision of all plants.

EARLE BUCKINGHAM, engineer with the Pratt & Whitney Co. and the Niles-Bement-Pond Co., has joined the teaching staff of the department of mechanical engineering at Massachusetts Institute of Technology. He will take up his new duties on December first.

T. L. KEELING has been appointed sales representative for the Climax Engineering Co., of Clinton, Iowa. Mr. Keeling will have charge of sales in Ohio, Western New York and Western Pennsylvania. He has established offices at 657 Leader Bldg., in Cleveland.

EDWARD E. ROBERTS has been appointed to represent the Firth-Sterling Steel Co. in the Western part of New York State. Mr. Roberts has long been associated with this industry, having specialized in heat-treating work for automobile plants and manufacturers of machine tools.

GEORGE L. ERWIN JR., has been appointed sales manager for the Kearney & Trecker Corporation, of Milwaukee. He was formerly connected with the St. Louis office of Manning, Maxwell & Moore, Inc., and later with the Chicago office of Kearney & Trecker.

L. A. CARTER, for the past twelve years connected with the Lehmann Machine Co., of St. Louis, as chief engineer and as president of the company, has established himself in business as consulting engineer and specialist on machine tool problems. He is at present located at the Lehmann plant.

H. FARROW, of Cleveland, is to succeed CARL ALCORN as manager of the stamping department of the Transue Williams Steel Forging Corporation, of Alliance, Ohio. Before coming to Alliance, Mr. Farrow was employed in the Velie Motor Co.'s plant at Moline, Ill. He has had several years experience in supervising manufacturing departments.

W. H. PATTERSON, formerly vice-president of the Kaestner & Hecht Elevator Co., of Chicago, and later vice-president of the John H. Dunham Advertising Agency of that city, has joined the industrial sales department, of the Westinghouse Electric and Manufacturing Co., at East Pittsburgh. Mr. Patterson will be in charge of the building industries division of the department.

DR. ALBERT SAUVEUR, who holds the Gordon McKay professorship in metallurgy and metallography at the Harvard Engineering School, has been engaged by Thomas S. Baker, president of Carnegie Institute of Technology, to give a series of three scientific lectures at the Pittsburgh institution on Nov. 30 and Dec. 1 and 2. The lectures, it is announced, will be given in the evening for the benefit of Pittsburgh scientists and steel men who may wish to attend. The subjects of Dr. Sauveur's lectures will be "Directional Properties and Dendritic Segregation in Steel," and "Hardening of Steel."

Business Items

The Acme Machine Co. has moved from 32nd St. to 929 Market St., in Paterson, N. J.

The Madison Tool and Stamping Co., of Madison, Wis., has taken over the business of the Bracket Co., Lancaster, Wis.

The Badger Sheet Metal Works, 1024-1026 Regent St., Madison, Wis., announces the acquisition of the entire business and equipment of the Globe Sheet Metal Works of Madison.

Sleeper & Hartley, Inc., designers and builders of wire coiling machinery, announce that they have taken over the spring coiling department of the American Can Co. New machines and repair parts will hereafter be handled through the former company.

J. H. Whiting has been elected chairman of the board of the Whiting Corporation, Harvey, Ill. Col. T. S. Hammond, who for many years has been vice-president and secretary, succeeds Mr. Whiting as president and treasurer. R. A. Pascoe succeeds Col. Hammond as secretary. R. H. Bourne, vice-president and sales manager of the corporation, succeeds Col. Hammond as president of the Grindle Fuel Equipment Co., a subsidiary of the Whiting Corporation. N. S. Lawrence, vice-president and assistant sales manager of the Whiting Corporation, is president of the Swenson Evaporator Co., another subsidiary of the Whiting Corporation. J. H. Whiting will remain actively engaged in the business. No change of policy is involved on the part of the Whiting Corporation and its two subsidiaries.

Obituaries

JOSIAH FRANCIS JOHNSON, manager of the general engineering division of the South Philadelphia Works of the Westinghouse Electric and Manufacturing Co., died suddenly in the Chester hospital on Nov. 12. Death was caused by a cerebral hemorrhage. Following his graduation from college Mr. Johnson entered the employ of the Westinghouse company and until 1906 was engaged in the shop testing of steam turbines. From this he was promoted to service work, and in 1910 he was field engineer and engaged in the erection, inspection and repair of steam power machinery. From 1910 until 1912 he was assistant district engineer with offices in New York, and district engineer of the Rocky Mountain District with offices at Denver, Colorado, where he had complete charge of all installation, inspection, and repair of all steam power apparatus.

W. C. BAILEY, treasurer of the National Malleable and Steel Castings Co., of Sharon, Pa., died suddenly on Nov. 16. He was 53 years old.

W. C. BROWN, treasurer of the Sun Machinery Co., of Newark, N. J., died on Nov. 6 at his home in Newark. He was 32 years old. Mr. Brown was at one time associated with the Simmons Machine Tool Co., of Albany, N. Y.

BETRAM T. JONES, head of the milling machine department of the Nordyke & Marmon Co., of Indianapolis, died recently after a long illness. Mr. Jones was at one time connected with Niles-Bement-Pond at Hamilton, Ohio.

EARL CLARK HOWARD, vice-president of the Cadillac Motor Car Co., died at the Clinic Hospital, Cleveland, on Nov. 14, after an illness of several months. Mr. Howard first joined the Cadillac organization in 1906. He formerly had been connected with the National Cash Register Co. He entered the Cadillac sales department and succeeded Ernest R. Benson as sales manager in 1912. Mr. Howard then left the company to organize the Lafayette Motors Corporation of Milwaukee, of which he became vice-president and general manager. He joined the Fisher Body Corporation in 1924, and in January of this year returned to the Cadillac organization.

Four General Electric Co. men were killed and two were injured in the train wreck which occurred on the Pennsylvania Railroad near Plainsboro, N. J., on Nov. 12. The dead include R. D. Reed, a member of the General Electric industrial department and in charge of the sale of electric arc welding equipment; Mark A. Atuesta and Arthur W. Gross, members of the manufacturing department, and John C. Horstman of the Manager's staff at the Schenectady plant. Among the injured were D. H. Deyoe of the industrial engineering department of the company, and Thomas Wry, of the Lynn River works.

All the men had met in Baltimore in connection with the inter-works welding committee of the General Electric Co. and were en route to the Bloomfield plant when the accident occurred.

Trade Catalogs

Trahern Rotary Pump. George D. Roper, Corporation, Rockford, Ill., has issued catalog No. 50, consisting of 38 pages, 6x9 in. in size, covering the standardized sizes of the "Trahern" line of rotary pumps including the lubricant pump for machine tools and the rotary gear, circulating, transfer and force pumps applicable to a variety of purposes.

There is included within the catalog ten pages of useful tables pertaining to pump operation.

Belting. Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Bulletin No. 1228 of the Transmission Department is devoted to an explanation of the Allis "Texrope" drive. Several illustrations of the equipment are shown. The bulletin explains the methods for estimating specifications for "Texrope" drive and contains a graph for determining the diameter or distance between centers.

Brass Products. Bridgeport Brass Co., Bridgeport, Conn. "A Historical Sketch of Bridgeport Brass Co.," is the title of a reprint from the *Metal Industry*, which is being distributed in celebration of this company's sixtieth year. The story is interesting and many side lights are thrown on life in the "sixties" and "seventies."

Forging Machinery. The National Machinery Co., Tiffin, Ohio, has published a 20-page, 10½ x 13½-in. book entitled "Carrying the Second Exposition of Forging Machinery to the Man Unable to Attend." Many views are shown of the equipment of this company as set up for exhibition purposes. Short commentaries accompany most of the photographs. The arrangement is attractive and interesting.

Scales. Toledo Scale Co., Toledo, Ohio. A folder bearing the title "Invisible Losses" has been published. Various types of Toledo industrial scales are illustrated and short paragraphs give the specifications.

Voltage Regulators, Automatic. General Electric Co., Schenectady, N. Y. Bulletin No. GEA-123 fully describes the methods and principles of operation of the General Electric voltage regulators. Details of construction of the various types are shown with photographs and line drawings. The bulletin contains sixty 8x10½-in. pages.

The information contained will be found valuable to those who have occasion to use these instruments, since the book is somewhat of a text on the subject.

Calendar of Local Meetings

American Society of Mechanical Engineers

Detroit Chapter. Nov. 28. "Methods of Taking Inventories."

New York Chapter. Dec. 8. "Case Problem in Standard Cost Variations," by N. M. Cartmell.

Albany Chapter. Dec. 9. "Laying Out the Cost Accounting Plan."

Worcester Chapter. Dec. 10. "The Treatment of Slow Moving Products in Inventory."

Los Angeles Chapter. Dec. 15. "Cost of Producing and Transmission of Power," (with pictures.)

Cleveland Chapter. Dec. 16. "Budgetry Control and the Principles of Burden Distribution."

Rochester Chapter. Dec. 16. The methods employed in Rochester industries in the collection and distribution of manufacturing burden. Speakers, I. W. Briggs and Z. L. Augustine.

Buffalo Chapter. Dec. 17. "Handling Production Costs from Raw Material to Finished Product."

Boston Chapter. Dec. 17. "Administrative and Selling Costs," by Charles F. Rittenhouse.

Scranton Chapter. Dec. 22. "Inventory Control," by LeRoy Chappell.

San Francisco Chapter. Dec. 28. "Preparing to Start the New Year Right—What Should Be Done?"

Society of Automotive Engineers

Indianapolis. Dec. 10. Indiana Section meeting. Subject: "High Duty Engines."

New York. Jan. 14. Annual dinner, Hotel Astor.

Detroit. Jan. 26 to 29. Annual meeting.

American Society for Steel Treating

Buffalo. Jan. 21 and 22. Winter sectional meeting, Hotel Statler.

Hartford. June. Spring sectional meeting.

Forthcoming Meetings

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., 29 West 39th St., New York City, Nov. 30, to Dec. 4. Calvin Rice, secretary, Engineering Societies Bldg., New York.

National Exposition of Power and Mechanical Engineering. Fourth annual event, Grand Central Palace, New York City, Nov. 30 to Dec. 5. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York City.

American Association for the Advancement of Science. Annual meeting, Kansas City, Mo., Dec. 28, 1925, to Jan. 2, 1926. Barton E. Livingston, secretary, Smithsonian Institute Bldg., Washington, D. C.

American Society for Steel Treating. Winter sectional meeting, Hotel Statler, Buffalo, N. Y., Jan. 21 and 22. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig iron demand is confined to small tonnage lots for prompt delivery; No. 2 fdry. Southern is $1.50 to $2 per ton above the Nov. 13 level. Iron and steel scrap rising. Current market shows considerable activity in steel plates and wire products. Little change occurred during the week in bars and shapes, the former remaining at $2 to $2.10 per 100 lb., Pittsburgh, with the latter at $1.90 to $2. Plates, however, are $1.90, Pittsburgh, or about 10c. per 100 lb. above the Nov. 13 level. Coke prices are the same as a week ago at Connellsville.

Non-Ferrous Materials—Lead prices are at Nov. 13 level in New York warehouses. Zinc dropped ½c.; copper, ¾c.; tin, 1½c. per lb. during week. Dealers are paying lower prices for scrap consequent to decline in non-ferrous metals.

(All prices as of Nov. 20)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	24.27
Southern Ohio No. 2	24.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.37
BIRMINGHAM	
No. 2 Foundry	22.50@23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.16
Virginia No. 2	29.17
Basic	23.16
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.27
Basic	22.27
Bessemer	22.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	5.00@5.50
Cleveland	4.90@5.00
Cincinnati	5.00@5.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.30@2.40	3.89	3.15	3.50
No. 12	2.35@2.45	3.94	3.20	3.55
No. 14	2.40@2.50	3.99	3.25	3.60
No. 16	2.50@2.60	4.09	3.35	3.70
Black				
Nos. 17 to 21	2.95@3.05	4.15	3.75	3.80
Nos. 22 to 24	3.00@3.10	4.20	3.80	3.85
Nos. 25 and 26	3.05@3.15	4.25	3.85	3.90
No. 28	3.15@3.25	4.35	3.95	4.00
Galvanized				
Nos. 10 and 11	3.40@3.50	4.35	4.25	4.00
Nos. 12 to 14	3.50@3.60	4.45	4.35	4.10
No. 16	3.65@3.75	4.60	4.50	....
Nos. 17 to 21	3.80@3.90	4.75	4.65	4.40
Nos. 22 to 24	3.95@4.05	4.90	4.70	4.55
No. 26	4.10@4.20	5.05	4.95	4.70
No. 28	4.40@4.50	5.35	5.10	5.00

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.15	50%	¾	$0.18	35%
⅜	.16	45%	1	.19	31%
½	.17	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.30 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	....	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	....	6.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	....	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	3.80	3.60
Cold drawn flats, squares	4.65	4.30	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	50@60%	55%	60%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb. *Flat, 1/16@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.00
Tin, 5-ton lots, New York			64.50
Lead (up to carlots) E. St. Louis	9.70	New York	10.75
Zinc (up to carlots) E. St. Louis	8.60	New York	9.62½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	21.00	20.75	20.00
Copper sheets, base	23.25	23.25	23.00
Copper wire, base	20.37½	17.25	17@17½
Copper bars, base	22.37½	21.75	22@22½
Copper tubing, base	25.25	25.75	25.00
Brass sheets, base	19.62½	19.62½	19.37½
Brass tubing, base	24.25	24.00	19.87
Brass rods, base	17.37½	17.37½	17.12½
Brass wire, base	20.12½	20.12½	20.50

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28@29	28.00	28.03
Zinc sheets (casks)	12.00	12.60@12.95	12.27
Solder (½ and ½), (case lots)	40.00	41.00	38@42
Babbitt metal (83% tin)	60.00	73.50*	58@63
Babbitt metal (35% tin)	28.00	23.50†	30@35
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

*92% tin. †5% tin and 77% lead.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.50@12.75	12.00	11.75@12.25
Copper, heavy, and wire	11.75@12.25	11.37½	11.25@11.75
Copper, light, and bottoms	10.00@10.25	9.75	10.25@10.75
Heavy lead	8.37½@8.87½	8.00	8.50@8.75
Tea lead	6.00@7.00	7.50	7.50@7.75
Brass, heavy, yellow	7.25@7.50	7.50	7.25@7.75
Brass, heavy, red	9.75@10.00	9.75	9.25@9.50
Brass, light	6.25@6.50	....	7.25@7.75
No. 1 yellow rod turnings	8.25@8.75	8.25	7.50@7.75
Zinc	5.25@5.75	4.75	5.00@5.50

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.50
"A" Grade:				
IC,	14x20	8.85	9.40	9.50
	Coke Plates—Primes.			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.75	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.20
Cotton waste, colored, per lb.	.10@.15½	.18	.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15½
Sal soda, per 100 lb. keg	2.25	2.25	2.75*
Roll sulphur, per 100 lb. keg	3.75	3.75	4.50
Linseed oil, per gal., 5 bbl. lots	1.02	1.13	1.01
Lard cutting oil, 25% lard, per gal.	.55	.50	.54
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40%	40%	30–10%
Heavy grade	30–10%	35%	30–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*In 175 lb. kegs.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.0415	.0415	.0405
Brass rods	per lb	.1737½	.1687½	.1612½
Solder (½ and ½)	per lb.	.40	.395	.39@.40
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40%	40%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.46	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.41	1.49
Cloth	3.55	2.67	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		6.50@7.00
Coke, prompt foundry, Connellsville	per net ton		7.00@7.50
White lead, dry or in oil	100 lb. kegs	New York, 15.75	
Red lead, dry	100 lb. kegs	New York, 15.75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger.
Case hardened ½x¼-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{3}{16}$-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ark., Little Rock—Arkansas Foundry Co., East 6th St.—moulding machine, cupola and sand blast equipment.

Calif., San Francisco—L. S. Leavy, City Purch. Agt.—shop equipment for proposed municipal garage on McAllister St. Estimated cost $91,700.

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal, will receive bids until Dec. 1 for punching machine, bits and cutter heads, etc.

Mass., South Boston (Boston P. O.)—Keystone Mfg. Co., 288 A St.—large and small punch presses.

Miss., Jackson—Martin-Parry Corp., H. C. Yawn, Jr., Plant Mgr., Lumberton—double cut off saws, shapers, tenoners, multiple boring machines, etc., for proposed 200 x 250 ft. truck auto body plant, here.

Mo., St. Louis—The M. M. Co., 3720 Natural Bridge—small lathe with tools.

O., Columbus—Linkenheil Planning Mill Co., 182 East Columbus St., E. C. Linkenheil, Mgr. and Treas.—soft sticker.

O., Columbus—J. H. Zinn Lumber Co., 19 East Hudson St., M. A. Grannan, Gen. Mgr.—2 stickers, 2 sanders, 2 planers, 4 cut off saws, 3 rip saws, 1 band saw, 1 jig saw, 1 shaper, 2 wood workers, 1 joiner and other equipment to replace fire loss.

Wis., Janesville—Rock County, c/o M. P. Richardson, 309 Jackman Blk.—machine tools for proposed 1 story machine shop for repair of road equipment. Estimated cost $10,000.

Wis., Milwaukee—A. Meckelbury Sash & Door Co., 760 31st St.—additional woodworking machinery for proposed 4 story, 50 x 140 and 58 x 120 ft.—also 1 story, 76 x 130 ft. addition to factory. Estimated cost $100,000.

Wis., Milwaukee — Northwestern Malleable Co., 756 Park St., C. S. Whitney, 214 Mason St., Engr.—3 ton electric traveling crane, 45 ft. span.

Wis., Wauzeka — J. Doll—woodworking machinery for the manufacture of cheese boxes.

Ont., Barry's Bay—Murry & Orr—complete saw mill equipment.

Ont., Windsor—Chrysler Motor Co. of Canada, J. D. Mansfield, Mgr.—additional equipment for motor factory.

Que., Aucienne Lorette—A. Brown—saw mill machinery and equipment.

Que., Barraute — M. Rivard (planning mill)—panel planer and combination saw.

Que., Cabano—A. Dube (planing mill)—mortiser and buzz planer.

Que., East Beauport—J. Grenier (sash, doors, etc.)—mortiser and tenoner.

Que., Montreal—H. Chagnow & C. Stee, 31 Burnett St.—(sawmill, etc.)—complete equipment to replace fire loss. Estimated cost $75,000.

Que., Montreal—P. Freres, 797 St. Christopher St.—milling machine.

Que., Montreal—E. Scott, 734 St. Paul St.—miscellaneous equipment for machine shop.

Que., Montreal—I. Suffrin, 1218 St. Laurence St.—lathe, planer, etc.

Opportunities for Future Business

Calif., Brawley—Brawley Union High School Dist., awarded contract for the construction of addition to high school including machine shops, etc. $159,750. Noted Nov. 19.

Calif., Los Angeles—Advance Auto Body Co., 1000 Macy St., awarded contract for the construction of a 2 story, 100 x 160 ft. factory. Estimated cost $65,000.

Calif., Los Angeles—Union Automobile Insurance Co., Lane Mortgage Bldg., awarded contract for the construction of a 2 story, 182 x 217 ft. addition to garage and office building at 6th and Loomis Sts. Estimated cost $150,000.

Conn., Greenwich — Putnam Corp., 23 West Putnam Ave., awarded contract for the construction of a 1 story, 112 x 206 ft. repair, sales and service station.

Fla., St. Petersburg—City voted $105,284 bonds for the construction of car barns and shops.

Ill., Chicago—C. E. Peterson Co., 4911 Wentworth Ave., is having plans prepared for the construction of a 1 and 2 story, 260 x 600 ft. sash and door factory at 82nd St. and Hoyne Ave. Estimated cost $300,000. F. E. Davidson, 304 South Dearborn St., Archt.

Ill., Chicago—Yoar Cab Co., 415 East 39th St., awarded contract for the construction of a 1 story, 100 x 175 ft. garage at 415 East 39th St.

Ill., Franklin Park — Central Lumber Terminal Corp., 20 West Jackson St., Chicago, has work under way on the construction of a group of buildings including a 1 story, 100 x 700 ft. lumber shed, 40 x 700 ft. shingle shed, 60 x 100 ft. mill and 2 story, 30 x 40 ft. office building here. Estimated cost $200,000. W. H. Sacket, is architect.

Ill., Granite City—Midland Coke & Iron Corp., 117 North 4th St., St. Louis, has taken over the properties of the St. Louis Coke & Iron Corp. and awarded contract for the construction of a new blast furnace and electric power plant here. Estimated cost $2,500,000. Noted Aug. 27.

Mass., Cambridge (Boston P. O.)—Massachusetts Wharf Coal Co., 30 Kilby St., Boston, awarded contract for the construction of a 1 story, 77 x 164 ft. garage and repair shop at Harvard and Main Sts. Estimated cost $50,000. Noted Oct. 29.

Mass., East Boston (Boston P. O.)—E. J. McHugh, 944 Saratoga St., will build a 1 story, 80 x 130 ft. repair and service garage. Estimated cost $50,000. G. J. Bateman, 15 Exchange St., Boston, Archt. Noted Sept. 17.

Mass., Lowell—Boston Auto Supply Co., 96 Bridge St., awarded contract for the construction of a 1 story, 46 x 200 ft. repair and supply shop on Bridge St. Estimated cost $40,000. Noted Oct. 22.

Mass., South Boston (Boston P. O.)—Gillette Safety Razor Co., 41 West First St., awarded contract for the construction of an 8 story, 73 x 167 ft. blade building and 75 x 152 ft. handle building. Estimated cost $450,000 and $400,000 respectively.

Miss., Jackson—Martin-Parry Corp., H. C. Yawn, Jr., Plant Mgr., Lumberton, will receive bids about Dec. 1 for the construction of a 200 x 250 ft. auto truck body plant here. Private plans.

Mo., Joplin—H. N. Van Fleet, 302 Wiggins St., Carthage, is receiving bids for the construction of a 100 x 200 ft. sash and door plant at Maiden Lane and B St., here, to replace fire loss. Southwestern Sash & Door Co., lessee. Noted Nov. 19.

Neb., Omaha — Metropolitan Utilities Dist., City Hall, is having plans prepared for the construction of a 2 story garage, warehouse, shops, etc., at 20th and Center Sts. Estimated cost $225,000. T. A. Leisen, City Hall, Engr.

N. J., Newark—Motor Improvement, Inc., 365 Frelinghuysen Ave., awarded contract for the construction of a manufacturing building. Estimated cost $200,000.

N. Y., New York—L. & W. Garage Corp., c/o M. Klein, 37 Graham Ave., Brooklyn, Archt., will soon receive bids for the construction of a 3 story, 100 x 100 ft. garage at 224 Mulberry St. here. Estimated cost $175,000.

N. Y., New York—Motor Inn Inc., R. G. Lipscombe, Jr., plans the construction of a 15 story garage at 39th St. and 8th Ave. Estimated cost $2,000,000. Architect and engineer not selected.

N. C., Asheville—T. C. Cox, c/o F. Coxe Co., plans the construction of a 3 story 128 x 140 ft. garage. Estimated cost $240,000. A. Wirth, is architect.

O., Cleveland—The Donley Bros. Co., G. Donley, Treas. and Gen. Mgr., 13900 Miles Ave., has had plans prepared for the construction of a 1 story, 60 x 160 ft. factory for the manufacture of metal building specialties. Estimated cost $50,000. W. Watson & Associates, 4614 Prospect Ave., Archts.

O., Cleveland—F. N. DuBois Co., Newark, N. J., manufacturers of plumbing supplies, awarded contract for the construction of five 1 story, 90 x 160 and 50 x 120 ft. factory buildings here. Estimated cost $300,000.

O., Cleveland—T. Knight, Superior Arcade, awarded contract for the construction of a 1 story, 132 x 163 ft. factory at 1515 Fairfield Ave. Estimated cost $50,000. Hollow Rib Co., 1729 Prospect Ave., roofing contractors, lessee.

O., Cleveland—The White Motor Co., T. R. Dahl, Secy., 842 East 79th St., awarded contract for the construction of a 1 story, 40 x 200 ft. heat treating plant. Estimated cost $100,000.

Ore., Portland—Corbett Bros., Corbett Bldg., is having plans prepared for the construction of a 4 story garage on Pine St. Estimated cost $250,000. A. E. Doyle, Worcester Bldg., Archt.

Ore., Portland—Meier & Frank Co., Morris and Alden Sts., is having plans prepared for the construction of a 4 story 200 x 200 ft. garage at 14th, 15th, Everett and Flanders Sts. H. A. Whitney, Lewis Bldg., Archt. Warehouse 200 x 260 ft. will be added later.

Pa., Economy (Ambridge P. O.)—Standard Seamless Tube Co., will build a 1 story, 34 x 80 ft. addition to machine shop. Estimated cost $70,000. Private plans.

Pa., East Lansdowne (Lansdowne P. O.) Richard R. Lloyd & Co., 105 North 22nd St., Philadelphia, will soon receive bids for the construction of a 1 story, 60 x 150 ft. woodworking shop on Pembrook Ave., here. R. A. Korns Jr., 109 South 22nd St., Philadelphia, Archt.

Pa., Philadelphia—P. S. Tyre, 114 South 15th St., Archt., plans the construction of a 4 story, 200 x 265 ft. sales and service garage at 3221-3239 North Broad St., for Packard Motor Co., 319 North Broad St. Estimated cost $1,000,000.

Tex., Amarillo—International Harvester Co., 606 South Michigan Ave., Chicago, Ill., awarded contract for the construction of a 3 story, 106 x 150 ft. warehouse and a 1 story, 80 x 100 ft. service station here. Estimated cost $225,000.

W. Va., Parkersburg—Ballinger Co., 12th and Chestnut Sts., Philadelphia, Pa., Archt., will receive bids until Nov. 29 for the construction of a 1, 2 and 3 story manufacturing plant including machine and carpenter shops, etc., for Viscose Co., Marcus Hook, Pa. Estimated cost $2,000,000.

Wis., Milwaukee—International Harvester Co., 784 Park St., awarded contract for the construction of a 1 story, 140 x 200 ft. factory. Estimated cost $65,000.

Wis., Milwaukee—School Board, will soon award contract for the construction of a prevocational school on Widlake Ave. Estimated cost $600,000.

Ont., Windsor—Chrysler Motor Co. of Canada, J. D. Mansfield, Mgr., awarded contract for 80 x 180 ft. extension to factory. Estimated cost $50,000.